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THE TWENTY-EIGHTH

ANNUAL REPORT

OF THE

MARYLAND AGRICULTURAL EXPERIMENT STATION

COLLEGE PARK,
PRINCE GEORGE COUNTY, MARYLAND

1914—1915

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The Maryland Agricultural Experiment Station

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The Board of Trustees of the Maryland Agricultural College.

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L. B. Broughton	*Assistant Chemist.*
R. S. Allen	*Assistant Animal Husbandry.*
K. C. Cole	*Assistant Agronomist.*
Miss L. E. Conner	*Librarian.*

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*In cooperation with the U. S. Department of Agriculture.

The Station is located on the B. & O. R. R. and City and Suburban Electric
Car Line, eight miles north of Washington, D. C.
Bell Telephone—Berwyn Exchange.

Visitors will be welcomed at all times, and will be given every opportunity to inspect the work of the Station in all its departments.

The Bulletins and Reports of the Station will be mailed regularly, free of charge to all residents of the State who request it.

ADDRESS:

AGRICULTURAL EXPERIMENT STATION,
College Park, Md.

LETTER OF TRANSMITTAL.

To His Excellency, P. L. Goldsborough,
Governor, and President of the Board of Trustees,
Annapolis, Maryland.

SIR:—In accordance with the provisions of Section No. 3 of the Act of Congress, approved March 2, 1887, 'To Establish Agricultural Experiment Stations,'' etc., I have the honor to transmit the Twenty-eighth Annual Report of the Maryland Experiment Station for the fiscal year ending June 3, 1915.

Very truly yours,

H. J. PATTERSON,
Director of the Experiment Station.

July, 1915.

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THE MARYLAND AGRICULTURAL EXPERIMENT STATION.

Vol. 28. 1914-1915.

TWENTY-EIGHTH ANNUAL REPORT OF THE MARYLAND AGRICULTURAL EXPERIMENT STATION.

For the Fiscal Year Ending June 30, 1915.

By H. J. PATTERSON, Director.

To the Board of Trustees.

Gentlemen:—I have the honor to submit the following summary of the work completed during the year with a brief outline of the investigations in progress at the present time, together with some suggestions as to the lines of work to be taken up in the near future.

Publications.

As soon as investigations are completed, or when they have gone far enough to make it desirable to make a partial report, the results are published in a bulletin. These bulletins are distributed to all the papers published in Maryland; to all the agricultural papers published in the United States; to the principal libraries of the world; to agricultural investigators, and teachers; and to the farmers of Maryland.

In addition to the general mailing list of Maryland farmers, we have special mailing lists so as to enable us to send bulletins pertaining to a special industry, to the persons most interested.

The publications of the Station gives in the main, the history and progress of the investigations conducted, and the annual report supplements the bulletins with the matter which they do not include.

The following bulletins were issued during the past year:

Date.	No.	Subject.	Author.
July, ...1914.		Annual Report for 1913-14.	
Aug., ..1914.	185	The Maryland Hog.	C. L. Opperman, S. S. Buckley, & R. H. Ruffner.

Oct., ...1914.	186	Land Drainage in Md.	J. R. Haswell.
Nov., ..1914.	187	Profitable and Unprofitable Cows.	G. E. Wolcott.
Dec., ...1914.	188	Types and Varieties of Maryland Tobacco.	W. W. Garner.
Jan., ...1915.	189	Grass and Rape Seed Inspected in 1913.	C. P. Smith.
Feb., ...1915.	190	Tests of Varieties of Corn.	W. E. Hanger.

Investigations in Progress.

Most of the investigations which are being pursued at present, have been in progress for several years. They are modified and supplemented from time to time as conditions necessitate. The funds available for investigational work have remained the same for a number of years, hence it can readily be understood that it is only possible to inaugurate new work as projects are completed.

Agronomy Department.

N. Schmitz.

The experimental work now under way is practically identical with that outlined in previous reports. The only changes to be made in the coming year are with the selection work with cowpeas and wheat. It has been found, for example, with both crops that continuously selecting for certain characters will not give results. For instance, the effort to get a cowpea which will mature all of its seed at once and which will grow more upright and produce more seed than any of the present varieties have been negative. The three varieties selected for improvement were the New Era, Whip-poor-will, and Wonderful. In each case 100 rows were planted from seeds of single plants, and from the 10 best rows the 10 best plants in each row were selected for planting the next season. After 6 years of such continuous selection the resulting seed was tested beside the seed of the original plant, but no improvement was found. In other words, after six years of continuous selection we have neither intensified nor changed in any way the original characters of the plant. The same thing is true with wheat. Our results are in accord with the results of other investigators and with modern ideas, which are that plants change suddenly rather than gradually. Hence, hereafter, all continuous selection of cowpeas and wheat will be discontinued and more efforts will be put forth to change the character of the plant by crossing and by selecting a larger number of individuals from the field, with the hope of finding one which already possesses the desired characters.

Green Manure Work.—The green manure work on the Scaggs property has developed as outlined in my last annual report, and we now have 170, 20th-acre plots devoted to green manure. There are 46, 20th-acre plots in which acid rock and floats are compared, and 48 limed plots, including 18 taken care of by this department for Mr. Broughton's investigations on the fineness of lime. This makes a total of 264, 20th-acre plots.

New Work.—The only new work to be taken up this year is with winter oats. In order to develop the most hardy winter varieties it will be necessary to conduct the work somewhere in the northern part of the State. This could probably be taken care of on some of the soil fertility farms to be established.

BOTANY AND PLANT PATHOLOGY.

J. B. S. Norton and R. C. Rose.

The most of the investigations in this department are being pursued under the provisions of the "Adams" Act.

Project A.—A study of the effect of the internal application of different substances to plants on their structure and physiology.

Project B.—A study of the effect of strong fertilization on cell function. This project is about completed, and results will be prepared for publication.

Project C.—A study of the effects of solutions taken up by the roots of the tomato on the development of parasitic fungi thereon. This work has been in progress for two years. The results have been negative. They will be published.

Project D.—A study of the life history of tomato blight fungus and the conditions of growth, culture, environment, etc. of the tomato in relation to the development of the same.

Project E.—Effects of sulphur and sulphur compounds on cell structure of plants.

Project G.—A study of the life history of fruit rotting Sclerotinias. Particular attention has been given to the brown rot of pome and stone fruits and the stage which produces blossom blight of fruits.

Project H.—Correlations of disease resistance in plants.

Project I.—Testing wilt resistant strains of canning tomatoes.

Project J.—Plant disease survey.

Project K.—Testing the use of oil sprays for eradicating Star-of-Bethlehem.

Project M.—Spraying for blight. This is being conducted in cooperation with the National Canners Association laboratory.

Project N.—Collecting and studying the native grasses of Maryland.

CHEMICAL DEPARTMENT.

H. J. Patterson, L. B. Broughton, H. J. White.

1. The special phosphoric acid and nitrogen tests on the one-tenth acre plots are being continued.

2. A study was made the past year on the effects of combinations of feeds on their digestibility.

3. A special study has been made of the solubility of different sizes of limestone, with the idea of determining the grade of fineness that is best suited to agricultural purposes. The laboratory work is being supplemented with field tests.

4. A study of the effects of different fertilizers on the rate of depletion of different limes in a loam soil.

DAIRY INVESTIGATIONS.

1. A study of factors which influence the food value of milk.
2. A study of some dairy rations.
3. Biometric relations in dairy animals.
4. Cooperating with the Extension Division in promoting silo construction, advanced registry testing, and cow testing associations.

ENTOMOLOGICAL INVESTIGATIONS.

E. N. Cory.

The investigations in this department are chiefly "Adams Fund" projects, and relate to the study of the leaf miner insects. The following gives a statement of the progress of the work to date.

Aquilegia Leaf Miner.

This pest was serious in 1914, and has reappeared this spring in unusual numbers, in certain localities on the Experiment Station grounds.

The first work on this insect was begun on May 11th, 1914. On that date the ruined leaves were found in numbers.

The following data has been obtained:

Life History.

Adult:—Phytomyza aquillegiae, Hardy.

Egg:—Deposited on June 6, 1914, under the writer's observation. Full notes on the oviposition were made.

Larva:—Slides made; length of this stage not fully determined.

Pupa:—Larva emerges from crescent shaped cut on lower side of leaf, pupates and usually remains attached to leaf for the greater part of this stage. First generation, pupal stage, about 14 days. As many as 33 pupae have been found per leaf. Last generation pupae winter over in the ground. First adults emerge about May 1st.

Control:—On weeds, not desirable. Where the pest is on rewintering pupae.

Parasites:—Sympiesis sp. and other in the hands of Mr. Gahan.

It will be seen from the foregoing that the life history has been worked out, except for the exact length of the larval stage, and the number of generations, and that the methods of control need further study.

The Chenopodium Leaf Miner.

This investigation is chiefly concerned with the food plants of this pest, seasonal history and prevalence. Biological work is being conducted.

Considerable data has been accumulated on all of the above points, and a large series of flies bred out for systematic studies.

Egg Stage:—1 to 4 days, differing with different specimens.

Larva Stage:—Undertermined, except by elimination.

Pupa Stage:—14 to 16 days, average close to 16 days.

Adult from Egg:—17 days in one case, this seems to be exceptionally short. Some parasites bred and in the hands of Mr. Gahan for determination.

Control:—One weed, not desirable. Where the pest is on related crops, control can be aided by eradication of the weeds.

This investigation should be continued and should be completed in 1916.

The Boxwood Leaf Miner.

Owing to summer school work, very little was done on this pest last year. From previous years work there has been determined the extent of injury, occurrence, egg laying, pupation and negative results on fumigation, contact spraying and trap lantern control.

Mr. Cory has made a translation of the only article of moment on this pest as published by Laboulbene in the Añnales de la Societé Entomologique de France, 1873. This does not give any biological facts, but is concerned chiefly with the description, which is excellent.

In Kingston, R. I., and in Baltimore, the only known points of occurrence of this common European pest in this country, the injury is such as to warrant careful work on its biology and control.

A New Holly Leaf Miner.

A serious pest of our native holly has been observed this year at Ammendale, Maryland.

Work has been begun on this pest. Adults have been bred out from collected material.

The amount of work that can be done on any of these pests is dependent largely upon the annual prevalence of the pests. The boxwood miner is likely to be present until we succeed in eradicating it, but this is not true of other insects under investigation.

It is, therefore, planned to pursue vigorously the investigations of the chenopodium and aquillegia miners this summer, and it is believed that the investigations can be concluded.

PLANT PHYSIOLOGY.

C. O. APPLEMAN.

The work in this department during the past year has been a continuation of the work outlined in my last report. The greater part of the time, however, has been devoted to the following two problems:

1. Relation of Catalase and Oxidases to Plant Respiration.
2. A Physiological Disease of the Potato Tuber (The Little Sprout Disease).

As the first problem was originally stated it included a study of the oxidases in their relation to respiration and at that time it was thought that the paper would be a short one, but as the work progressed, unexpected developments gave the problem much greater importance than was first anticipated.

The chemical mechanism responsible for the oxidation processes in plants with the resulting releasal of energy, has long been a question of prime importance in plant physiology. The workers who have attempted to explain the mechanism of respiration have assumed that the oxidases are fundamentally involved in this process, although no one has ever quantitatively demonstrated this relationship. The investigator found that the enzyme catalase was strikingly correlated with respiration in the potato tuber. Catalase is an enzyme that is present in all cells and is especially abundant in the potato tuber, but it has never been assigned a satisfactory function.

These respiration studies have suggested some important relationships to practical agriculture. One which has been given considerable thought is the possibility that the difference in yield among varieties of the same plant species may be practically explained on the basis of respiration. A great variation has been found in the intensity of respiration among different varieties of potatoes. The difference between the total amount of dry weight assimilated by photosynthesis and the total amount dissimilated by respiration is the increase in dry weight—the net result of normal plant growth. If respiration is in excess of the energy needs of the plant there is an absolute loss to the plant in dry weight. If, on the other hand, the plant is an economic worker the loss in the above case would be added to the dry weight. Difference in yield in the same variety might result from too low respiration due to an insufficiency of certain fertilizers which act as co-enzymes or to conditions which impede the necessary gaseous exchanges.

I have made the foregoing statements simply to indicate some of the possible, broader applications of work which may seem on the face of it entirely unrelated to agricultural problems; but in the present state of our knowledge on the subject it is the kind of work that is absolutely necessary.

The work on the "Little Sprout" disease, which has consumed considerable time during the past year, has presented some puzzling situations. Twice the data collected has been prepared for publication when unexpected things suddenly arose. In the fall crop of 1913, there was found for the first time, in fall harvested potatoes, what was supposed to be the same trouble which had been previously thought was characteristic only of summer harvested potatoes.

Although the little sprout symptom was nearly identical in both cases, the metabolic behavior in some respects was very different. The material in the 1913 crop was rather scarce, so the work was held over to be verified on the fall crop of 1914. From the work on this crop, it can be safely stated that we have a symptom which is almost identical with an important symptom of the disease in the summer harvested potatoes, but resulting from a very different cause. From the evidence at hand, it would seem that the tubers in the fall crop showing the little sprout symptom were produced by plants suffering from either the curly dwarf or leaf roll disease.

POULTRY INVESTIGATIONS.

R. H. Waite.

The following experiments are in active progress at present:

Experiment No. 6.

Fertility of Egg Experiment.

Several hundred eggs were incubated and records kept to get additional data on the time necessary for eggs to become fertile after the male was turned in with the flock.

Experiment No. 7.

Records were kept on several thousand eggs as to length of time they were kept before incubation. These records will, when added to those of last year, give a pretty good indication of how long eggs can be safely kept.

Experiment No. 8.

Leg Weakness.

No specific work has been done on this problem the past season.

Experiment No. 9.

The white egg cross-breeding work has not been pushed owing to lack of facilities. It is hoped that next year yards will be available so that this experiment may be continued. After the second cross it requires several pens to conduct breeding experiments with poultry.

Experiment No. 10.

Sex Mortality in Chicks.

It was utterly impossible with all the other work on hand to continue this work which requires close application every day of the brooding season.

Experiment No. 11.

A new feeding experiment was started December 1st, the immediate object of which was to find if possible a vegetable concentrate that will (wholly or in part) take the place of commercial meat feeds in a ration for laying hens.

Need for this Experiment:—The quantity of meat production is becoming of serious concern to the people of this country. Every day more and more of what were formerly considered waste products of the slaughter-houses are being made use of in human foods. The amount of meats exported has been falling off each year, but still the price of meats have risen. It has been the history of nations that when they become thickly populated the production of the large meat animals drops off and poultry and poultry products are much more depended upon.

If then we are going to raise more poultry and less meat, the refuse of which is quite largely used in the feeding of poultry, it is certain that we must look elsewhere for our protein supply.

Procedure:—Soy beans are a crop which can be produced on the farms in this State. They have a high protein content and there are reasons for believing that they may be a valuable poultry food. If they should so prove, there is no reason why they cannot be raised for such purposes.

Gluten feed is a by-product from the manufacture of certain corn products and as corn is coming to be more and more the staple food product of this country, its by-products are apt to be valuable for feeding purposes. Gluten feed appeared to be a good poultry food when used in connection with beef scrap in our Experiment No. 4, and it should be worth while to see what it will do alone.

Cottonseed meal is a product which has not proven of value in the feeding of growing chickens, but it has never been given a real trial so far as I can determine for its value as a feed for mature laying hens. Some trials should be made at this Station, if for no other reason than getting some reliable publication before the inquiring public.

A ration (No. 2) has been made up of feeds whose feeding value for poultry is fairly well known. This will be fed to one of the check pens and the other rations made to conform to it as nearly as feasible in regards to total protein content and total crude fiber. It is believed that this will make the rations more comparable than they would be if figured on the nutritive ratio basis. The variation in the carbohydrates and fats cannot be very well corrected and still have the rations practical ones.

The mashes in all pens, except pens 5 and 6 which get whole grains only, will be made up of bran (equal amount in each ration), corn meal (proportion varies somewhat in each ration), middlings (equal proportion), the concentrate being tested and salt (equal amounts). The grain rations will all be alike, except No. 5 and each pen will receive grain and mash in equal amounts.

The rations are as follows:

Pen No. 1—

Bran	100 lbs.
Corn Meal	50 lbs.
Middlings	100 lbs.
Soy Bean Meal	100 lbs.
Salt	2 lbs.

Pen No. 2—

Bran	100 lbs.
Corn Meal	100 lbs.
Middlings	100 lbs
Beef Scrap	50 lbs.
Salt	2 lbs.
Corn	175 lbs.
Wheat	175 lbs.

Pen No. 3—

Bran	100 lbs.
Corn Meal	75 lbs.
Middlings	100 lbs.
Cottonseed Meal	75 lbs.
Salt	2 lbs.
Corn	175 lbs.
Wheat	175 lbs.

Pen No. 4—

Bran	100 lbs.
Corn Meal	25 lbs.
Middlings	100 lbs.
Gluten Food	125 lbs.
Salt	2 lbs.
Corn	175 lbs.
Wheat	175 lbs.

Pen No. 5—

Corn	Equal parts.
Wheat	

Pen No. 6—

Corn	275 lbs.
Wheat	275 lbs.
Soy Beans	150 lbs.

Pen No. 7—

Bran	100 lbs.
Corn Meal	62½ lbs.
Middlings	100 lbs.
Beef Scrap	12½ lbs.
Sow Bean Meal	25 lbs.
Cottonseed Meal	18¾ lbs.
Gluten Meal	31¼ lbs.
Salt	2 lbs.
Corn	175 lbs.
Wheat	175 lbs.

Pen No. 7 will be another check and may tell a valuable story, perhaps showing a minimum amount of the feed that can be used.

It is possible that some of the rations may have to be changed as the experiment progresses, especially the cottonseed meal ration.

Each pen, except No. 5, will consist of 40 S. C. White Leghorn pullets, all raised on the plant and given the same general treatment, prorated so as to be as nearly alike as possible. Pen No. 5 will contain 20 pullets.

The mashes will be before the birds in metal hoppers and the grain fed twice daily in the litter. Water, grit, shell and granulated bone will be kept before the birds at all times. Whenever green feeds are fed or the birds turned out in their yards, all will be treated alike and records kept.

The rations have been figured roughly from Henry's and other tables, but composite samples will be taken of each mash for a complete chemical analysis.

There has been some difficulty encountered in the way of disease, roup having developed in the cottonseed meal pen and spread to the others. After about two months' feeding, the cottonseed meal pen became so sick and out of condition that the meal had to be discontinued. A so-called "War Ration," consisting of corn, 250 lbs.; bran, 100 lbs.; middlings, 100 lbs.; beef scrap, 50 lbs., and salt 1¼ lbs., was substituted and the pen picked up immediately and did as well as any. This pen received a little over 10 per cent. of cottonseed meal. Another pen received but 2½ per cent. and seems to be doing well. This taken with experience gained with cottonseed meal at the R. I. Station indicates that cottonseed meal should be very cautiously fed to poultry and 10 per cent. is certainly too much.

Experiment No. 12.

Some records were taken of the temperature of shelters sought by chicks on scorching hot days. This was done because it was thought that some ideas on summer housing of poultry might be found. Chicks crowd under houses when possible, but our records show that most any other shade is cooler. Possibly the ground is cooler under buildings. Additional records will be kept this summer.

EQUIPMENT.

We are gradually getting the equipment destroyed by the fire back in shape. During the year the following items were added:

Set of trays for making egg storage.
Set of instruments for autopsies.
New Hall colony brooder.
Two new Prairie State portable hovers.
New fences around long house.

We still need to put a chick, cat and dog-proof fence around the whole plant. This will make it possible to conduct more work with reference to growing young chicks. We are moving several of the colony houses together to make a long house.

POMOLOGICAL INVESTIGATIONS.

W. R. BALLARD.

The work for the past year has been largely a continuation of that of the previous year. A few new lines have been started but some of these are breeding projects in the nature of attempts to hybridize unlike types, the results of which are usually quickly ascertained.

Strawberries.

A number of new varieties of strawberries have been tested, descriptions made and yields recorded. Visitors on "Farmer's Day" seemed much interested in the test plots and this may prove to be one of the best ways of disseminating information concerning new and desirable sorts. Breeding work with the fall-bearing types is being carried forward.

Small Fruits.

Most of the varieties of black raspberries have succumbed to disease, and, on account of the poor results secured with this type, it does not seem advisable to renew the beds. A few of the red caps will be continued as they seem better adapted to our conditions.

A study is being made of new methods of handling and training dewberries. The blackberries are in good condition and are giving profitable yields of fruit.

The old bed of currants is getting in bad shape and will be removed as soon as the new planting can be made. Stock of most of the desirable varieties have been propagated and are about ready for planting out. The gooseberries in the old plot are still in fairly good condition.

Grapes.

The training and trellising experiment is now well under way. A test is being made of the Munson canopy, one-wire Kniffin, two-wire Kniffin, two-wire umbrella, three-wire umbrella and fan systems.

Progress with grafting has been slow on account of lack of material and unseasonable conditions. It is hoped that by the spring of 1916 a sufficient number of grafts will be available for a test of the variety Delaware on seven different stocks. A number of vinifera grapes have also been grafted on resistant stocks and will soon be ready to set into a permanent vineyard. For this purpose the plot of ground formerly used by Captain Silvester as a garden would be highly desirable if available next spring.

About fifty grape seedlings will fruit this season and their behavior will be watched with interest. Results in breeding this fruit can be secured in much less time than with orchard fruits and there seems to be a big field here for valuable work. Over eight hundred seedlings were secured from last year's crosses. These will be planted rather close in order to economize space, the majority should fruit the third-year from the seed. Undesirable individuals can thus be early eliminated.

Quinces.

Several of the varieties of quince in the test plot will fruit this year. It is the plan to study the cause for the very apparent prevalence of poor results in the production of this crop. An attempt has been made to hydridize with the Japanese quince, which as far as my observation extends is entirely free from the fire blight which is so destructive to the cultivated quince.

Pears and Apples.

Blooming periods with pears and apples (as well as with other fruits in my charge) have been recorded as usual. Studies of varietal characteristics are being made, together with a continuation of observations on the relative immunity to diseases.

Some breeding work is still being carried on with these fruits, but more attention is being given to inducing the production of fruit on seedlings now growing. Quite a number of these were in fruit last year, a few of which were rather promising. About two hundred seedlings bloomed this spring, and a majority of these have set some fruit.

The new orchard planted last spring has made fair progress despite the very dry season last year. A few more trees were added this spring, including six from the Geneva Experiment Station, these being the second distribution of desirable sorts from their breeding projects.

STONE AND NUT FRUITS.

F. S. Holmes.

The Adams Fund project, which includes a study of some of the factors influencing the hardiness of the peach, has been continued, with minor changes, as outlined in previous reports. Containers for growing dwarf trees have been secured which there is every reason to believe will prove satisfactory. A means of maintaining a constant soil moisture content has been worked out in a satisfactory manner, though delay in manufacturing the special apparatus required has prevented the installation. This material should be received in a short time, however. This project should be carried on without much additional expense for material equipment. It is believed, however, that sea sand of the best grade should be secured for growing these trees in rather than soil. This will make possible the control of the salts supplied the trees with as high a degree of accuracy as the water supply. The value of this feature in a control experiment of this kind is at once apparent. This would require about 600 cubic feet of sand. A site 100 feet square with enclosing fence should be leveled up and I would suggest a point southwest of the greenhouses as desirable.

Material for a bulletin on plums and cherries, similar to the station bulletins on other fruits has been collected and will soon be in shape for publication if thought desirable. It is believed that the data secured from the variety plum orchard planted twelve years ago should be utilized in this way. It does not seem desirable to take up any new work during the coming year.

VEGETABLES AND FLOWERS.

Thomas H. White.

The work with vegetables and flowers, as outlined in last year's report, has gone forward without any material interruption. The fertility work with crimson clover and tomatoes which is in its third year will be set back one year on account of failure to get a stand of crimson clover last summer. It will be necessary to prepare the land this year, especially for crimson clover, in order to secure a stand to work with. Again, last year, the same as the year before, there was a slight gain in favor of the plot where the clover was fed and returned as manure. Not so much, however, but that it might be attributed to some other uncontrollable factors.

A new series of plots, which are designated as Series E, bearing on trucking fertility problems have been laid off in the old orchard patch. These are designed to give some data on how much manure or fertilizer it requires annually to keep the soil fertile. One set of four will be used with manure alone, 4-8-12 tons per acre with a check plot. Another set of four will have $8.00, $16.00, $24.00 worth of fertilizers and a check. A third set of four will have half the amount of manure and half the amount of fertilizer that is applied to the other two sets.

The rhubarb patch has been increased in size this season so that some experimental work in fertilizing may be attempted next year.

The hill selection tests of McCormick potatoes commenced last year will be continued. Some investigators have reported remarkable increases and variations from hill selection. The work here last year, however, showed no increase or decrease from high or low yielding hills; some of low yielding hills of last season being high yielders and vice versa. There were other variations, such as the presence of curly dwarf disease, causing a dwarfing of the plant which decreased the yield and there was also a ''sport'' which was pink between the eyes and not in the eye, as was the old McCormick.

The strain tests of tomatoes are being continued. The strains of Globe furnished by Mr. Myers, of Pennsylvania State College, did not show the same variation in yield in the greenhouse last winter that they did with him previously in the field. The stock was badly mixed with other varieties. These were not counted in the record of yields. The value of the variety and strain tests are probably more far reaching than it appears at first sight. The American Seed Trade Association, through their secretary, has written again this year asking for criticisms, etc., and expressing a desire to cooperate with the Experiment Stations in assisting the grower. Judging from some of the seedmen's methods of doing business, all that seemed important was the pecuniary side. In order to check this and stop the fraud practiced on the buyer of seeds by flaming advertisements reporting great successes of an old variety under a new name, it would be necessary to submit new things to some central point for standardization and registration. This is done by the rose, carnation and chrysanthemum growers. It saves the uyer wasting his time and money on some thing that is no better than old things on the market.

A case in point where the seedsman is trading on the credulity of the buyer is the ''John Baer'' tomato, which sells for $2.00 per ounce.

This is the same tomato as Bonny Best, which is selling for 25 cents per ounce.

The work with fertilizers as related to variations and mutations shows no marked differences, except with the cherry tomato. With this the difference in vigor and deep color of foliage, as previously noted, still obtains.

A brief summary of the work in vegetables and flowers is as follows:

Asparagus.	Fertilizer experiments.
Cabbage.	Variety exeriments. Also study of hardiness and resistancy to disease. Saving seed from resistant varieties.
Cantaloupes.	Varieties and selection of desirable individuals for resistancy to disease. Saving seed from resultant
Potatoes.	Quantities of potash and amounts of fertilizer per acre. Home-grown August planted seed versus Maine-grown and second crop Virginia. Hill selection of White McCormick for high yield, better shape, etc. The value of large bin selected tubers versus small ditto; also variety testing.
Peas.	Variety tests and inoculation experiments.
Tomatoes.	Crossing for better canning variety. Selection of good individuals from standard sorts. Variety testing.
Rhubarb.	Variety testing. English varieties.
Celery.	Varieties, also home-grown seed for adaptability.
	Testing miscellaneous vegetables for seedsmen and interested gardeners.
Mushrooms.	Continuation of investigation affecting growth.
Ornamental Plants.	Adaptability of varieties and species for home grounds decoration.

The work in the greenhouse is a continuation of previous work and includes tests of fertilizers and commercial manure on roses, carnations and chrysanthemums.

The work with the pollination of the greenhouse tomato has run three years and shows great benefit from hand pollination on all varieties.

The geraniums this year have been planted in blocks to test the relative merits of Mr. Ballard's seedling, "Maryland," and some of the older varieties. These are in the garden directly south of Agronomy barn.

Soil Fertility Investigations.

The special appropriation made by the State for soil and fertility investigations has not been available owing to the financial condition of the State. Hence there has been no work inaugurated under the act.

RIDGELY SUB-STATION FARM.

The Ridgely Sub-Station Farm is located within the town limits of Ridgely. It consists of 50 acres of land mostly tillable, and is improved by a very good house and two tenant houses and a stable and a few other outbuildings in poor repair. The farm was purchased by the State from the Caroline County School Board at a cost of $15,000. The State appropriated $1,500 per year for two years for conducting investigations on the farm. The farm was turned over to the Experiment Station on October 1st, 1914. Up to date, the State has paid over $375.00 of the appropriation, and the town assessment for sidewalk took $364.00 of this amount. This left practically nothing for operating the farm for the first nine months. The work that has been done has been paid for out of the general funds of the station. The work so far has been principally of a demonstrative character, and making preliminary tests as to uniformity of soil, etc., to be used as a basis for future work.

During the past winter, Mr. Haswell, the drainage engineer in the employ of the United States Government, made a drainage survey of the Sub-Station farm and has recently completed his work and has furnished complete maps and detailed instructions for the draining of the farm. The estimated cost for this work is between five and six hundred dollars.

The following tests are either in progress or planned for on the Ridgely farm for this season:

Strawberries.

Variety Test Work.

The following varieties of strawberries have been set out and are under observation. Longfellow, Senator Dunlap, Twilley, Gold Dollar, Excelsior, Sample, Early Ozark, Saunders, Bradley, Chesapeake, Aroma, Rewastico, Superb (fall bearing), Progressive (fall bearing), Tennessee Prolific.

Cultural Experiments.

There are five ⅜-acre plots of strawberries which are receiving the following different cultural treatments:

Plot 1—Local practice.
Plot 2—Lime.
Plot 3—No lime.
Plot 4—Mulching test.
Plot 5—Fertilizing test.

Tomatoes.

During the summer ⅛-acre test plots will be conducted in connection with the following varieties of tomatoes: Greater Baltimore, Red Rock, Stone, Shallcross, Matchless, Whitford's Choice, M. A. E. S. Canner, and Chalk's Jewel.

Value of Nitrogenous Fertilizers.

To determine the money value of increased quantities of nitrogen in the tomato fertilizers, the following test will be conducted:

One plot will be treated with 2-8-2 goods; another with 4-8-2 goods and the third with 6-8-2 goods.

Studies of Fusarium Wilt: A large number of varieties will be employed in this work.

Spraying Experiments for Blight, etc.: For this work acre plots of Stone, Greater Baltimore, Shallcross and Red Rock will be used. This work will consist largely of different spraying treatments, both in the bed and in the field.

Cantaloupes.

In this work an effort will be made to determine, through observation, the best rust-resisting varieties of cantaloupe. Approximately two acres of land have been set aside for this purpose.

Soil Fertility Work.

Sufficient land has been set aside for this work for starting it next fall.

Fertilizer Versus Stable Manure.

For this work four 3/8-acre plots have been laid out and are now in the course of preparation for the first year's crop, which will be cantaloupes. This work has been planned for a period of seven years and will include a practical rotation of local crops.

Soudan Grass.

This will be more in the nature of a practical demonstration of this comparatively new forage crop.

Variety Test of Corn, Wheat and Oats.

The wheat and oats work has already been mentioned and needs no further comment at this time. The variety tests of corn for the present include Thomas Munikhuysen, Leaming, Massey Boone Co. White, Skipper, Radebough Boone Co. White, Collier Excelsior, Funk's Yellow Dent and Maryland Twin.

Preparing Corn Land for Wheat.

Two half-acre plots have been laid out for this work. One is now in wheat and the other is to be seeded to corn. Crimson clover is to be the basis of fertilization.

Variety Tests of Soy Beans.

During the present year thirty-two different varieties of soy beans will be tested out for seed and hay yields.

Good Seed Multiplication Work.

In this work there will be included soy beans, corn, wheat, oats, cow peas, etc.

Potato Demonstration.

Demonstrations in the growing of late potatoes will be conducted on an acreage plan during the present year.

Pruning and Spraying Demonstration.

During the spring of 1915 a pruning and spraying demonstration was held in the orchard of the Sub-Station Farm. Prof. Shaw, of the Extension Department, was in charge of the work. The Station orchard is sprayed regularly in accordance with the methods that are advocated by the parent institution.

SEED INVESTIGATIONS AND INSPECTION.

C. P. Smith.

All the investigation done in the Seed Laboratory during the past year has been too meager and scattered to permit much of a detailed report. Such investigations have been along the line of improving our methods in making purity and germination tests, where need of improvement was quite evident. The use of our new sampling machine and the application of logarithms in the computation of percentages have both proved to be valuable in our purity work. Hyattsville gas and running water have made general germination work both a possibility and a reality.

The greatest needs for another year are more room space, double our present capacity for filing samples, and also for making germination tests. Our present conditions for germination work, while giving excellent results for most seeds are proving unsatisfactory in the case of blue grass and red top, and, as these seeds require special conditions and a 28-day test in each case, experiments to determine the special factors necessarily to be met for these seeds will have to be made. Two additional germinators are therefore needed.

285 samples of garden peas, beans, and corn, field peas, cow peas, field corn, spring oats, etc., have been collected for germination studies and probable publication. Over 500 samples of clovers and grasses have also thus far been collected for both purity and germination testing for publication under 1915 inspections. All our grass seed samples of 1914 are still to be tested for purity for publication. We are still working on the clover bulletin of 1914 inspections.

One of our student assistants is working exclusively on germination tests for 1915 samples. Two others are helping Mr. K. E. Smith with the purity testing.

BIOLOGICAL LABORATORY.

S. S. Buckley.

The work conducted in this department this year has been confined to the manufacture of hog cholera serum. The demand has been sufficient to keep Dr. Buckley and two helpers busy the entire time. They have always had serum available to meet the demands of Maryland farmers. The price of serum has been reduced 2-10 of a cent per c. c., but this is still higher than the charge made by some manufacturers that operate on a large scale. Our plant and methods have been inspected and meet the requirements of the United States Bureau of Animal Industry. The producing end of the work of making hog cholera serum would seem to be fairly satisfactory, but better means for distributing and administering should be provided. The farmers must be impressed with the necessity of treating the hogs before they get sick. The serum is a *preventive* and not a *cure.*

Amount of serum produced July 1st, 1914, to June 30, 1915	119,590 c. c.
Amount of serum distributed July 1st, 1914, to June 30, 1915	206,794 c. c.

FINANCES.

The Station is not able to meet all the demands upon it with the funds now available, but the plan of keeping expenditures within the appropriations has been closely followed and the Station continues as in the past to operate on a cash basis.

The following report of the Treasurer shows the details as to the expenditures for the past fiscal year:

MARYLAND AGRICULTURAL EXPERIMENT STATION.

In Account With

THE UNITED STATES APPROPRIATIONS.

Dr.

	Hatch Fund.	*Adams Fund.*
To appropriations for fiscal year, 1914-15	$15,000.00	$15,000.00

Cr.

By Salaries	11,413.77	9,959.40
Labor	2,561.06	560.23
Postage and Stationery	24.44	117.04
Publications	472.99	....
Freight and Express	....	109.07
Heat, Light, Water and Power	....	338.67
Chemicals and Laboratory Supplies	....	29.62
Seed, Plants and Sundry Supplies	209.74	161.49
Fertilizers	318.00	63.22
Feeding Stuffs	....	1,405.75
Library	....	217.01
Furniture and Fixtures	....	195.00
Tools and Appliances	....	189.34
Scientific Apparatus	....	1,247.51
Traveling Expenses	....	48.18
Building and Repairs	....	359.47
Total	$15,000.00	$15,000.00

The above is a true copy.

WIRT HARRISON, *Assistant Treasurer.*

MARYLAND AGRICULTURAL EXPERIMENT STATION.

In Account With

THE STATE APPROPRIATIONS.

DR.

	General Fund.	Horticultural Fund.
Balance on hand July 1st, 1914	....	$1,218.49
Received from the State for fiscal year, 1914-15	$9,500.00	1,000.00
Received from Interest on Deposit and Refund	....	174.70
Total	$9,500.00	$2,393.15

CR.

	General Fund.	Horticultural Fund.
By Salaries	1,910.73	710.77
Labor	1.248.67	30.40
Publications	585.20	568.61
Postage and Stationery	127.58	79.66
Freight and Express	157.56	46.48
Heat, Light and Water	176.71	13.75
Chemicals and Laboratory Supplies	194.76	13.56
Seeds, Plants and Sundry Supplies	545.14	400.86
Fertilizers	663.62	361.13
Feeding Stuffs	1,466.34	......
Library	87.68	35.24
Tools and Machinery	679.41	88.67
Furniture and Fixtures	224.75	1.20
Scientific Apparatus	61.17	....
Live Stock	558.00	....
Traveling Expenses	260.95	94.39
Contingent Expenses	148.52	....
Buildings and Repairs	524.25	....
Balance	206.96	*51.59
Total	$9,500.00	$2,444.78

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*Overdraft.

The above is a true copy.

WIRT HARRISON, *Assistant Treasurer.*

MARYLAND AGRICULTURAL EXPERIMENT STATION.

Account of Farm Sales.

Dr.

To Balance, July 1st, 1914	$158.29
Receipts from Sales of Farm Products and for Labor of Teams and Men	10,078.27
Total	$10,236.56

Cr.

By Salaries	$1,200.00
Labor	7,587.02
Publications	271.21
Postage and Stationery	59.77
Freight and Express	553.72
Heat, Light and Water	15.90
Seeds, Plants and Sundry Supplies	50.77
Feeding Stuffs	56.80
Library	35.50
Live Stock	12.00
Traveling Expenses	4.40
Contingent Expenses	26.09
Buildings and Repairs	24.50
Balance	338.88
Total	$10,236.56

The above is a true copy.

Wirt Harrison, *Assistant Treasurer.*

MARYLAND STATE BOARD OF AGRICULTURE.

In Account With

THE BIOLOGICAL LABORATORY FUND.

DR.

To Balance on Hand, July 1st, 1914	$186.17
Received from Sale of Serum, Hogs and Meat, etc., 1914-15	4,748.56
Total	$4,934.73

CR.

By Salaries	2,641.78
Labor	97.50
Laboratory Supplies	203.47
Feed	732.10
Live Stock	39.00
Tools and Implements	6.00
Scientific Apparatus	46.56
Heat and Light	1.57
Library	2.00
Postage and Stationery	10.62
Contingent Expenses	10.60
Balance	1,143.53
Total	$4,934.73

The above is a true copy.

WIRT HARRISON, *Assistant Treasurer.*

MARYLAND STATE BOARD OF AGRICULTURE.

In Account With

THE SEED INSPECTION FUND.

DR.

To Balance, July 1st, 1914	$876.26
Received from State Appropriation, 1914-15	750.00
Overdraft	1,188.18
Total	$2,814.44

CR.

By Salaries	1,800.00
Labor	435.63
Traveling Expenses	230.68
Laboratory Supplies	72.47
Scientific Apparatus	31.21
Postage and Stationery	80.62
Publications	158.83
Contingent Expenses	5.00
Total	$2,814.44

The above is a true copy.

WIRT HARRISON, *Assistant Treasurer.*

THE MARYLAND AGRICULTURAL
EXPERIMENT STATION.

BULLETIN No. 185. AUGUST, 1914.

STATISTICS--HOUSING--FEEDING--CARE AND MANAGEMENT--MISCELLANEOUS INFORMATION.

C. L. OPPERMAN.

The Present Status of the Swine Industry in Maryland.

INTRODUCTION.

It is common knowledge that the swine industry of Maryland is and has been for a number of years at a very low ebb in so far as the production of pork is concerned. Instead of raising on our farms enough hogs to supply the citizens of our towns and cities we are actually importing every year from sister States vast quantities of pork and pork products to meet their demands. Yet in the face of this evidence practically every hog breeder within our borders will tell you that for the money invested there is no other animal on the farm which will yield so large a profit. In point of fact the hog has been described as "A great natural resource, a farm mortgage lifter and debt payer, and the most generally prolific and profitable domestic animal in American agriculture." If he merits this reputation why is it that our farmers pay so little attention to him? To answer the question is difficult, but it is quite probable that the extension and spread of hog cholera and diseases generally are largely responsible for existing conditions. Then again it is obvious that there are any number of farmers who actually do not realize the monetary possibilities of swine production, for even in localities where hog cholera has not been at all prevalent, there are many farmers that produce barely enough pork for home consumption. In many other instances not even this quantity is home grown.

The practical question is can these conditions of low production be overcome and are the farms and native crops of Maryland such as will lend themselves to a greatly increased output? It is the purpose of this bulletin to show that substantial improvement can be made in this industry in our State and to offer suggestions and plans for bringing about this desired end. Many of the practical suggestions given are the results of experiments conducted at this and other stations and of information procured from a survey of swine conditions in Maryland.

THE SIGNIFICANCE OF THE 1909 CENSUS FIGURES.

It is quite evident, from a perusal of the figures on swine production as set forth in the last census, that the farmers of Maryland have reached the point in breeding and growing hogs where it becomes an actual economic necessity to find out just why the total value of swine in Maryland is only $1,765,857, while in Iowa the same class of live stock on an area of 5,057,140 acres, which is the exact area of farm land in Maryland, represents a cash value of $10,367,137. Surely we are not willing to admit that the soil and climatic conditions of Iowa are six times more favorable than those of our own State for the production of porkers.

Perhaps the best way to gain an idea of the actual conditions of this industry in our home State will be to compare census figures bearing on swine in the Commonwealth of Maryland with those of Iowa. Such a comparison is to be found in the following table.

TABLE 1. COMPARISON OF SWINE CENSUS.

	Total No. Farms.	Total No. Swine.	Total Value of Swine.	Average Acreage per Farm.	Average No. Hogs per Farm.	Average No. Acres per Hog.
Maryland	48,932	301,583	$1,765,857	103	6.16	16.6
Iowa....	217,044	7,545,853	69,693,218	156	34.7	4.5

From the above figures it is at once apparent, regardless of the difference in size between the two States, that Maryland farmers are using approximately four times as many acres per hog as are the farmers of Iowa. Again, if these figures are followed, we find that there are only six hogs per average 103-acre farm in Maryland, while on a farm of equal area in Iowa there are supported approximately 25 head, or just four times as many. These two points are striking features of the comparison and it is quite clear, even to one who has not made a study of conditions, that the main trouble with the industry in this State can be traced directly to underproduction for the resources available. There is no question but that the fertile soil of Maryland can just as easily support one hog to every four or five acres as can that of Iowa.

THE RESULTS OF A DETAILED CENSUS OF THREE COUNTIES.

The comparison of averages cited in connection with general census figures of 1909 is of much interest and value. At best, however, these are only relative and it is to the detailed data from individual farms that we must look for positive information in relation to the exact status of the swine industry. By consulting Table 1 it will be seen that general averages give an allotment of 6.16 hogs per farm. This figure is similar to any general average that would be reached through the use of mass data of this description. It really tells no vital story, but is simply another way of stating how many hogs there are in the State. It tells us nothing about the farms having no hogs, those with but one or two, or of the breeder maintaining from 25 to 100 head. We can hardly expect to make pertinent suggestions looking to a greater production unless we know something more definite about these conditions.

Since it was impossible to make a complete detailed census of all counties, on account of the large amount of time, money and labor involved, it was thought best to select a county in each of three different sections of the State. In making these selections the geographic location, total size and area in farm lands were given careful consideration. The idea was to have counties of nearly equal area and so located that different sections of the State would be represented. With this thought in view, Washington, Queen Anne's and Charles Counties were chosen for the work.

In Tables 2, 3 and 4 are presented the tabulated results of the detailed census of the distribution of swine in the three counties mentioned above. A brief study and comparison of these tables will be interesting as regards the industry in Maryland.

TABLE II.

Distribution of Hogs Over 3½ Months of Age in Washington County, Census of 1909.*

Dist. No.	Total No. Farms.	Total No. Hogs.	Farms with no Hogs.	Farms with 1 Hog.	Farms with 2 Hogs.	Farms with 3 Hogs.	Farms with 4 Hogs.	Farms with 5 Hogs.	Farms with 6-10 Hogs.	Farms with 11-25 Hogs.	Farms with 26-50 Hogs.	Farms with 51-100 Hogs.
1	96	1047	2	2	2	8	10	13	23	29	6	1
2	94	672	5	3	9	9	8	11	27	21	1	0
3	8	43	2	0	0	2	1	0	1	2	0	0
4	109	1749	1	3	9	7	8	7	15	36	20	3
5	101	575	4	4	19	8	18	12	30	3	3	0
6	86	785	2	3	8	13	9	3	25	19	3	1
7	82	400	6	7	12	15	13	4	18	6	1	0
8	117	786	10	4	27	14	12	5	25	16	3	1
9	141	2189	6	3	8	12	13	3	35	41	12	8
10	81	979	1	4	4	4	6	3	26	25	7	1
11	74	326	2	8	17	7	14	5	19	2	0	0
12	96	1370	0	0	8	5	11	7	21	29	12	3
13	99	1309	7	0	5	7	9	4	27	25	13	2
14	33	800	5	0	0	0	0	1	4	13	4	6
15	112	595	8	10	22	16	5	12	28	9	2	0
16	106	976	1	3	13	5	13	8	32	26	5	0
17	6	57	2	0	0	0	1	0	2	0	1	0
18	100	948	2	6	8	11	11	5	28	21	8	0
19	69	525	5	2	6	9	3	4	25	13	2	0
20	77	1071	2	5	2	3	6	2	17	27	13	0
21	36	460	2	0	1	1	1	3	12	12	4	0
22	25	211	2	0	1	1	4	4	8	4	1	0
23	92	765	8	5	6	8	4	8	26	24	3	0
24	32	294	0	1	3	3	5	5	8	5	1	1
25	44	278	0	1	8	3	8	1	16	7	0	0
Total	1916	19210	85	74	198	171	193	130	498	415	125	27

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*Note.—These figures were compiled from duplicates of the original enumerators' sheets as furnished by the United States Census Bureau.

WASHINGTON COUNTY.

Table 2 which deals with conditions in Washington County presents the following data:

1.	Total number of farms	1,916
2.	Total number of hogs, over 3½ months of age	19,210
3.	Number of farms with no hogs	85
4.	Number of farms with 5 or less hogs	766
5.	Number of farms with 6 to 10 hogs	498
6.	Number of farms with 11 to 25 hogs	415
7.	Number of farms with 26 to 50 hogs	125
8.	Number of farms with 51 to 100 hogs	27
9.	Number of farms reporting pure breds	44

Frederick is the only county in Maryland that exceeds Washington in the production of hogs, and in face of such evidence is it not at once obvious that these detailed census figures are of tremendous value? Here in the second largest hog-producing county in the State we find that there are 85 farms having no mature hogs and 766 farms where but five or less are maintained. More than one-third of all the farms in the county are credited with five or less hogs—mostly less. If we were drawing conclusions from the averages of the general census we would naturally consider Washington County an illustration of the splendid possibilities for pork production in Maryland, but when we examine its merits in this connection with the powerful searchlight of a detailed individual farm census, we find it falls far short of being the criterion we had assuemed it. General averages scratch the surface and lead us to hasty conclusions, while the exact figures procured only through the consideration of each and every farm get down to bed rock and thus establish a foundation for a plan of real progress and improvement.

A still more definite division of these 766 farms will be of interest Of this number 74 kept one hog; 198, two hogs; 171, three hogs; 193, four hogs, and only 130 actually had five hogs on the farm at the time of the enumeration. Thus we can see how the total of a single column of figures, even in connection with a detailed census, does not really mean anything in particular except a generalized statement until the figures in it are divided and sub-divided into groups that represent a single actual condition.

In preparing the detailed census of the counties they were divided according to the established election districts in order that the resulting data might be employed to the best advantage in pointing out some of the contributory causes of the present low production. Examples of this nature follow.

In Clear Spring District No. 4 there are 109 farms having a total of 1,749 hogs, while in Indian Spring District No. 15 there are 112 farms—three more than in Clear Spring—having a total of only 595 hogs. Both of these districts are given up largely to agriculture and have but few towns of any important size. Generally speaking one is just as favorable as the other for the breeding and growing of hogs and yet Clear Spring District is producing three times as many as Indian Spring. Hancock District No. 5 presents practically the same condition as is found in Indian Suring, the former having 101 farms on which there are but 575 hogs. The question naturally comes up as to the reasons for this low production in Districts 5 and 15.

The physical character of the land which is rolling and mountainous in all three sections can hardly be construed as having any particular bearing on the question. A concrete example of this statement is seen in the figures for Ringgold District No. 14. The greater part of this district is decidedly mountainous, yet on the 33 farms included in it there are 800 hogs, or 225 more than are found on the 101 farms in Hancock District. Additional argument in connection with the physical character of the land would appear to be superfluous.

Another argument that might be put forth as being responsible for the dearth of swine in the districts referred to is that the orcharding interests have overshadowed those of animal husbandry. That this is erroneous, however, is again proven by the number of swine in Ringgold District. Aside from the few large commercial orchards scattered over the western section of the county, Ringgold District is undoubtedly a leader in horticultural activities, and instead of decreasing the number of hoge amintained the added interest in this pursuit would appear to be conducive to a greater output of pork and pork products.

We have seen that neither topography nor special agricultural interests such as orcharding, etc., materially influence the swine production of any given locality. Therefore, we must look elsewhere for the cause or causes of high and low production. In analyzing the subject, the writer takes the position that the age of the county, population and the characteristics of the inhabitants are the factors which influence to a great extent the condition of the industry in any given section. Viewed from a strictly agricultural standpoint, it is of course true that the topography of a section and the character of its soil will in a measure influence the population and determine the class of people that settle it, and thus indirectly have some bearing on the question at hand. It must be conceded by all that the level and more easily tilled sections are the first to be populated and developed and that the more rugged districts are for a time given up to lumbering, mining and allied pursuits. On the other hand to say that the physical nature of a rolling and mountainous section prohibits the production of swine or other live stock would be erroneous. We have abundant evidence to substantiate this statement in the data for Districts 5 and 15. For example, in District 5 there are 30 farms maintaining from 6 to 10 hogs, three with 11 to 25 hogs and three with 26 to 50 hogs; in District 15 there are 28 farms maintaining from 6 to 10 hogs, nine with 11 to 25 hogs and two with 26 to 50 hogs. Numerous other examples could be cited, but these mentioned will suffice for present needs.

In speaking of the age of a section as influencing the status of the swine industry, the thought in mind is the age as measured by the length of time that particular section has been well populated and developed. We often come in contact with the term "New Country," meaning, in most instances, country that has not been populated to any great extent with the view of conquering it for agricultural pursuits or industrial development. Sections of the county included in Rohrersville, Sandy Hook, Indian Spring and Hancock Districts are good examples of this sort of territory. All are fairly rugged in character and have naturally remained more or less dormant from an agricultural standpoint, while the more level and easily tilled portions of the county have enjoyed substantial progress along this line.

A section may be new in so far as agricultural development is concerned and yet enjoy a fairly good sized population. Lumbering and mining interests, railroad construction, etc., are often the mediums through which such population is made possible. It is only natural that the people following these pursuits should manifest little or no interest in agriculture. If they remain in the country after these interests have ceased to be active, as many of them do, they either make their homes along the railroad and in the small towns, or they acquire a few acres in the country about them. They are dependent largely upon local work as a means of livelihood and are seldom active in the real agricultural development of the community. Another type of inhabitant that is to be found in these so-called new districts is the farmer who cannot afford to purchase land in the older, more developed farming districts. The purchase price of an acre in the latter districts will often secure for him ten times that area in the newer country, and since his resources are small he is of necessity compelled to invest in the cheaper land. In this environment we can hardly expect him to produce more than enough pork to supply the family larder during the first few years which are given up to the clearing and fencing of his land. In later years when the home is well established and the fields are in condition for cultivation there will be a natural increase both in farm crops and live stock.

From a very brief observation of the subject we have seen that the age of the country, its poulation and the characteristics of its inhabitants will in a measure influence the agricultural development of that particular section. This applies to animal industry development as well as to that of other rural pursuits. On many of these farms which show a low hog production, however, we should not lose sight of the fact that in proportion to their age as measured by agricultural development the number of hogs in these districts as reported in the 1909 census is far below what it should be. Too many farmers who are already well established in these districts are not utilizing their resources to the best advantage in the breeding and growing of hogs. This point is brought vividly to our attention by the fact that in District 5 there are 66 farms; in District 8, 72 farms; in District 11, 53 farms, and in District 15, 75 farms, the majority of which are maintaining less than four hogs. If we expect the hog industry in Maryland to measure up favorably with its splendid resources, this condition must be changed.

That the industry can be greatly augmented in all sections of the county is strikingly shown in the figures for Leitersburg District No. 9. On the 141 farms in this district there is a total of 2,189 hogs, or an average of 15 head to every farm. Only six farms are reported as having no hogs and but 40 with five or less. Clear Spring District No. 4 also shows a flourishing condition of the industry. The 109 farms in this district report a total of 1,749 hogs, or an average of 16 head to every farm. If these results are possible in the above-mentioned sections, there is no logical reason why many more of the other districts, with equally favorable conditions, should not be doubling and trebling their present output of pork.

An instance of this underproduction in the more favorable districts of the county is to be seen in the figures for Wilson District No. 23. In this district there are 92 farms having a total of only 765 hogs, while in the adjoining Clear Spring District No. 4 there are 1,749 hogs maintained on the 109 farms which make up the section. Both districts are of about the same area and given up almost exclusively to agricultural pursuits, and yet one is producing more than twice as many hogs as the other. Not only is Clear Spring District producing twice as many hogs as Wilson, but it is accomplishing these results under less favorable conditions than are enjoyed by the sister district. A large portion of the west and northwest section of the former is hilly and mountainous, while the greater part of the latter is level rolling country. Of the favorable farming districts of the county Wilson does not stand alone as the only section where the production of porkers is not in comparison with the resources available. A brief study of the table will show that there are several others in a similar condition. That all these can be greatly improved is evident from the flourishing condition of the industry in sister districts, and the question that each and every producer has to answer is, are we going to take advantage of our opportunities?

TABLE III.

Distribution of Hogs Over 3½ Months of Age in Queen Anne's County, Census of 1909.*

Dist. No.	Total No. Farms	Total No. Hogs	Farms with no Hogs	Farms with 1 Hog.	Farms with 2 Hogs.	Farms with 3 Hogs.	Farms with 4 Hogs.	Farms with 5 Hogs.	Farms with 6-10 Hogs.	Farms with 11-25 Hogs.	Farms with 26-50 Hogs.	Farms with 51-100 Hogs.
1	257	1450	16	27	42	27	26	15	60	43	1	0
2	173	1756	6	9	14	17	6	7	43	62	8	1
3	177	1881	11	8	17	11	9	11	44	54	9	3
4	96	1393	0	3	6	1	4	3	23	43	12	1
5	143	1583	2	9	17	9	7	4	34	52	7	2
6	186	1077	13	21	27	17	10	13	57	28	0	0
7	147	839	9	15	18	21	15	10	38	20	1	0
Total	1179	9979	57	92	141	103	77	63	299	302	38	7

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*Note.—These figures were compiled from duplicates of the original enumerators' sheets as furnished by the United States Census Bureau.

Queen Anne's County.

Turning to Table 3 we note the following data for the swine industry of Queen Anne's County.

1. Total number of farms 1,179
2. Total number of hogs, over 3½ months of age............9,979
3. Number of farms with no hogs........................ 57

4. Number of farms with 5 or less hogs	476
5. Number of farms with 6 to 10 hogs	299
6. Number of farms with 11 to 25 hogs	302
7. Number of farms with 26 to 50 hogs	38
8. Number of farms with 51 to 100 hogs	7
9. Number of farms reporting pure breds	16

The topography of Queen Anne's County is quite different from that of Washington. Practically the entire area of the county is composed of low, level land well suited to the growing and breeding of hogs. Yet even under these ideal conditions we find the industry in much the same condition as that of the county previously discussed.

With the exception of its shell fish and other sea food industries, this county is devoted almost entirely to agriculture, and yet we find 57 farms on which it is reported there are no hogs maintained. Again more than one-third of the farms in the county are supporting five or less of these animals. Of the farms reporting five or less hogs we find that 92 keep one hog; 141, two hogs; 103, three hogs; 77, four hogs, and only 63 of the 476 farms of this division are credited with the maximum of five animals.

In a comparison of the districts we find that Centerville District No. 3 leads all others in the production of pork, Churchill No. 2 and Queenstown No. 5 being close seconds.

The average number of hogs per farm in Districts 1 and 7 is five and a fraction, while in the sister District No. 2 we find the farms supporting 10 and a fraction, or just twice as many. This is a condition precisely similar to that found in Washington County in Districts 4 and 23. In both instances the sections showing high and low hog production are equally well adapted for the growing of pigs and the only explanation of the great differences existing is that the one is making good use of the available resources while the other is content with merely keeping the industry alive.

In all low producing districts we invariably find a goodly number of farms on which there are good sized, thrifty herds of swine, thus clearly proving that the industry can be and is being profitably conducted in that particular section. As an instance of this we note that in District 1 there are 60 farms having from six to 10 hogs and 43 with herds numbering from 11 to 25 head; in District 7, 38 farms are carrying from six to 10 hogs and 20 on which there are being maintained from 11 to 25 hogs. It is quite evident that in the majority of cases it is the man and his methods and not the location, nor physical character of the district that is responsible for the status of the industry in any given section.

Taking the county as a whole, the hog population is more evenly distributed than in Washington County, yet as has been pointed out, practically similar conditions of high and low production exist. That there are not any striking differences in production between the various districts is due probably to the fact that there is little if any of the so-called "new country" areas, such as were found in the latter county. This country has been developed as a whole and no one particular section has remained dormant from an agricultural standpoint on account of physical imperfections.

TABLE IV.

Distribution of Hogs Over 3½ Months of Age in Charles County, Census of 1909.*

Dist. No.	Total No. Farms	Total No. Hogs.	Farms with no Hogs.	Farms with 1 Hog.	Farms with 2 Hogs.	Farms with 3 Hogs.	Farms with 4 Hogs.	Farms with 5 Hogs.	Farms with 6-10 Hogs.	Farms with 11-25 Hogs.	Farms with 26-50 Hogs.	Farms with 51-100 Hogs.
1	61	461	2	3	13	4	6	6	16	8	3	0
2	63	505	4	6	18	7	8	7	5	3	3	2
3	128	732	3	16	22	16	11	16	31	12	0	1
4	131	958	4	6	16	12	10	16	42	21	4	0
5	82	830	3	3	7	6	6	7	26	18	4	2
6	116	881	3	8	15	13	23	13	22	13	4	2
7	25	161	1	1	6	1	2	4	7	2	1	0
8	88	684	7	5	16	9	5	2	23	16	4	1
9	80	572	4	2	10	14	9	6	18	16	1	0
Total	774	5784	31	50	123	82	80	77	190	109	24	8

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*Note.—These figures were compiled from duplicates of the original enumerators' sheets as furnished by the United States Census Bureau.

CHARLES COUNTY.

For Charles County, the third and last of the detailed census, we have the following data on the swine industry compiled from Table 4.

1.	Total number of farms	774
2.	Total number of hogs over 3½ months of age	5,784
3.	Number of farms with no hogs	31
4.	Number of farms with 5 or less hogs	412
5.	Number of farms with 6 to 10 hogs	190
6.	Number of farms with 11 to 25 hogs	109
7.	Number of farms with 26 to 50 hogs	24
8.	Number of farms with 51 to 100 hogs	8
9.	Number of farms reporting pure bred hogs	3

Here again we find the general condition of the swine industry very similar to that previously described in connection with the other two counties. Instead of a third of the farms in the county reporting a hog population of five or less, however, as was the case in Washington and Queen Anne's, we find here more than half the farms show this condition. By splitting up these 412 farms into specific groups we note that 53 have one pig; 123, two pigs; 82, three pigs; 80, four pigs, and 77, five pigs. In addition to these, 31 farms reported no pigs at all.

A further instance of high and low production in districts that are equally adapted to hog raising is seen in data for Districts 3 and 5 of Charles County. On the 128 farms in District 3 there is a total of 732 hogs, or an average of 5.7 head per farm, while in District 5 we find an average of 10.1 hogs per farm, or a total of 830 head on the 82 farms of the district.

That the absence of so-called "new country" has the tendency to more or less equalize the production of hogs in the various districts of a county is again evident from the figures depicting the status of the industry in Charles County. There are no violent extremes of high and low production such as were found in the former sections.

TABLE V.

Summary Sheet for Washington, Queen Anne's and Charles Counties, Showing Distribution of all Swine.*

County	Total Area Acres	Area in Farm Acres	Total No. Farms	Total No. Hogs.	Farms with no Hogs.	Farms with 5 or less Hogs.	Farms with 6-10 Hogs.	Farms with 11-25 Hogs.	Farms with 26-50 Hogs.	Farms with 51-100 Hogs.	No. of Farms Reporting pure Breds.
Wash.	293,760	231,191	1916	19,210	85	766	498	415		27	44
Queen			1179	9,979	57	476	299	302	38	7	16
Anne's	233,600	219,072	774	5,784	31	412	190	109	24	8	3
Charles	296,960	232,337									
Totals	824,320	682,600	3869	34,973	173	1654	987	826	187	42	63

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*Note.—These figures were compiled from duplicates of the original enumerators' sheets as furnished by the United States Census Bureau.

A Comparison of Conditions in the Three Counties.

The bringing together of the summaries in Table 5 for each of the three counties included in the detailed survey has been done in order that some of the most vital points, which would appear to be largely responsible for the present low status of the swine industry in Maryland, might be more thoroughly impressed on the mind of the reader.

Without further reiteration of comparisons we may say that the three following points have already been well established in the previous discussion.

First, that large tracts of new country in any given district of a county are, generally speaking, a reasonable excuse for low production as regards swine.

Second, that many districts which are well developed from an agricultural standpoint are not utilizing their resources to the best advantage for the production of hogs.

Third, that when the topography of a county is of similar character throughout, the status of the swine industry will be more or less uniform in all districts and the opportunities for developing the industry may be regarded as limited by the best district.

Returning to the data included in Table 5, we note the following additional points:

1. Of the three thousand, eight hundred and sixty-nine farms in the three counties, one thousand, six hundred and fifty-four, or 45.3 percent, are maintaining five or less hogs over three and one-half months of age.

Here is a condition the existence of which we could hardly believe unless the absolute figures were before us. The figures for Washington County showed that one-third of the farms fell in this class, for Queen Anne's one-third and for Charles one-half. Since each of these counties is typical of the section of the State it represents, namely Western and Northern Maryland, Eastern Shore and Southern Maryland, we may justly assume that at least one-third of the fifty thousand farms in our great commonwealth would have to be placed in this class. With these undisputed figures before us is it not easy to understand why it has become necessary to import each year, from sister States vast quantities of pork and pork products to meet the demands of the citizens in our towns and cities? Instead of growing just enough for home consumption the great majority of these farms should be producing pork for the market.

2. Of the total farms, one hundred and seventy-three report no hogs at all.

In our interpretation of the data procured from the detailed census we feel that we should be liberal enough to concede that there are certain conditions which make hog raising undesirable on a small percentage of the farms in Maryland. It may be true that a portion of these 173 farms are not doing their part in the work of building up a greater swine industry in our State, but the other reasons which have been advanced as to the present low status are so thoroughly convincing that we will pass over the present point without further comment.

3. The majority of the farms keeping more than five hogs are to be found in the columns represnting from 6 to 25 hogs.

The figures in this division of the tables more nearly represent the logical number of hogs that should be found on every general farm. Of the great proportion that falls in the division of five or less, we may say that in all probability no breeding stock is maintained, but that the pigs are purchased from neighboring farmers for fattening purposes. Those falling in the division of 6 to 10 more than likely support one brood sow and those found in the 11 to 25 class maintain two or more. If the majority of farms now maintaining from 6 to 10 hogs would add another brood sow or two and those that have no sows at all, at least one, the future prospect for a greater industry would be augmented very materially.

4. With practically the same area in farm land and with equally good natural advantages for swine production, Charles County is credited with but 5,784 head of hogs as against 19,210 for Washington County.

In this comparison we see one of the most striking explanations for the low status of the swine industry in the State. Here in Southern Maryland, as portrayed by the figures for Charles County, we find that a little more than 40 acres of farm land is available for the support of every individual hog. In Queen Anne's practically 22 acres is available for every hog and in Washington County approximately 12 acres. It is at once obvious that the farmers of Northern and Western Maryland are the present leaders in the utilization of their resources for fostering and building up a greater swine industry. The Eastern Shore occupies second place and Southern Maryland third and last. There is no doubt but that the industry can be materially increased in Northern and Western Maryland, yet the fact remains that it is to the Eastern Shore Counties and more particularly to those of Southern Maryland that we must look for the greatest advancement. To simply increase the hog population in the two low producing sections of the State until it equaled that of Northern and Western Maryland, as portrayed by the data for Washington County, would mean an increase in value to the industry of many thousands of dollars. The application of the suggestions in paragraph three would make such an increase possible.

As has been previously pointed out, Charles County is credited with 232,337 acres of farm land. It is probably true that this amount represents the area actually included in the 774 tracts that have been bought and sold under the name of farms. To assume, however, that the term ''farm land'' means productive cultivated fields would be obviously erroneous. Instead of being under the plow there are thousands of acres of this land that are at present raising bumper crops of broom sage and scrub pine, and a more correct name for such areas would be abandoned land. If by arousing interest in the hog industry we can bring about the rejuvenation of these nonproductive areas Southern Maryland, instead of being the lowest producing section in the State, should become second to none in the growing of porkers.

5. Notwithstanding the increased number of large farms in Charles and Queen Anne's Counties, the majority of the large herds of swine, those numbering from 26 to 100 head, are found in Washington County.

This condition is directly opposite to what we would naturally expect, for it would appear logical to look for the large herds on the farms of greater area. The figures in the table, however, show that just the opposite is the case in this instance. Investigation into the condition has shown that the continued sale of the young weaned pigs from the farm has occasioned the small herds so frequently encountered in the two former counties. The markets of Baltimore and Washington are supplied with young pigs at all seasons of the year largely from the water-front counties of the Eastern Shore and Southern Maryland, whereas the young stock of the more inland counties, namely Northern, Central and Western Maryland, are retained on the farm and used as a medium by which the farm crops may be converted into a finished product. Not only are the herds of the former sections depleted by the early marketing of the young pigs, but the most profitable source of marketing the corn crop is also eliminated. The corn must be sold for cash or fed to other live stock that cannot compare with the hog as a money maker. If the corn is sold for cash, as is frequently the case, the fertility of the land is also impaired, for when marketed through the hog the valuable plant food contained in the manure, remains on the farm and at the same time the price received for the product is considerable in excess of that which would be realized through the selling for cash. Thus by the retention of the young pigs on the farms of the low producing sections another step in advancement will be made toward a greater hog industry in the State.

7. Of the 3,869 farms, but 63 or 1.7 percent reported pure bred herds.

It is at once evident that where we find the industry in a flourishing condition we also find the greatest percentage of pure breds. This would tend to substantiate the oft-repeated statement that pure breds are more profitable than the mongrels. Of the 63 herds 43 were in Washington County, 16 in Queen Anne's and 3 in Charles.

It would hardly seem necessary in this day to argue for pure breeds on the farm and yet the evidence presented would certainly warrant it. The points in favor of the pure breeds over the scrubs are mainly greater uniformity throughout, especially adapted to exacting marketing demands, more profitable for breeding purposes, and more attractive to the eye. They cost no more to maintain than the mongrels and with their added virtues it is surprising that more farms are not keeping them. The chapter which is devoted to breeds and breeding is recommended to all readers who are at present depending on the pine rooters for their hog dollars.

Why We Should Have A Greater Swine Industry.

As dropping water is said to wear away stone so is reiteration necessary in order to press home a truth on the mind of the average reader. Some of the points in the subsequent paragraphs have already been touched upon in the previous discussion, but the repeating of them in the present discussion may be the means of bringing about the proper recognition of their importance. Why then should we have a greater swine industry?

First, because our farm lands can produce maximum yields of all the crops which are essential for economic pork production. Corn, the king of all, will yield 10 and 12 barrels to the acre in Maryland as readily as it will in Iowa or any other State in the Union, and clover, alfalfa, rape, oats, vetch, cowpeas, soybeans and the numerous other forage crops make a luxuriant growth under proper methods of culture. Again our climatic conditions are almost ideal for live stock of any kind. The mild open winters make expensive shelters unnecessary, which materially reduces the cost of production. The natural water supply of the State is second to none and our freedom from droughts such as visit the west at frequent intervals, is practically assured at all times.

Second, because there are thousands of acres of land now lying idle that could be put to good use in the breeding and growing of hogs. Particularly is this true of that portion of the State known as Southern Maryland. Here scrub pine and broom sage occupy enough splendid agricultural land to double our present output of pork if it could be utilized for such a purpose, and there would still be left ample room for the tobacco, corn and other staple crops. While it is true that this condition exists in this part of the State, there is at the same time ample room for increased production in many other localities not adjacent to Southern Maryland.

Third, because as the census figures show that with corresponding advantages and resources the farmers of Maryland are producing only one-fourth as many swine as those of Iowa. Surely this is a deplorable state of affairs for the swine industry of Maryland.

Fourth, because the producers in Maryland have a market at their very doors which is second to none. Contrast this condition with that of the farmers of Iowa and other Western States, who are compelled through force of circumstances to sell at wholesale prices to buyers located in Chicago, Omaha, Kansas City and other large western shipping points. Truely, Maryland is fortunate in this respect. There are at the present time many farmers in our State who are making a specialty of converting the hog into a finished product right on tho farm, and it may be said to their credit that they are making a splendid success of the enterprise.

What a wonderful field this presents to the enterprising, progressive farmer. For example, such densely populated centers as Washington, Baltimore, New York, Boston, Philadelphia and many other small cities are simply awaiting the introduction of sugar-cured hams, home-made sausage, scrapple, snow-white lard and all other products of the hog to become enormous consumers of the same. The idea of packing a weekly basket hamper full of the many good things that it is possible to produce on the farm and delivering it by parcel post or other means to the city home is no longer the ideal of some dreamer, but is fast becoming an actual present-day reality in those States which enjoy splendid transportation facilities, and short hauls to large centers of poulation. Maryland enjoys these advantages and they should argue well for a much greater development of that process of marketing which has as its main advantages the elimination of the middleman and increased profits for the producer.

Fifth, that the manufacture of "hog anti-cholera serum" at the Experiment Station has placed a means within the reach of all for preventing the heavy mortality often caused by hog cholera. It is now possible, at very little expense, to have the herd immunized against this most dreaded of swine diseases.

Little is left to be desired. We have the soil to produce the crops, the climate which insures healthy, vigorous animals, a market that is ripe for development and a positive preventive of the most deadly of all swine diseases.

Housing the Hog.

In making a survey of the swine industry in Maryland the writer was not surprised to find the hog house, when it was in evidence, about the poorest building on the farm. The general impression seems to be that anything is good enough for a hog. Yet as a matter of fact there is no animal on the farm that requires betier protection from the cold than the hog; none for which a good bed is more necessary, and none so much in need of the health-giving sunshine as the young pig. In many instances where hog shelters were in evidence they were either so poorly constructed or absurdly planned that the hog would have been better off if not compelled to nhabit them. On the other hand not a few were found that were well built and carefully planned for the hog's comfort and in Figures 5, 6, 7, 8 and 9 are given photographic views of several such houses. The writer's first plan in connection with the present bulletin was to describe in detail several of these houses, but upon making investigation it became very evident that such a scheme was impractical because of the great variety of hog houses found in different sections. Practically every piggery possesses certain features peculiar to itself and made necessary by the conditions which it is intended to meet. Thus it would appear more feasible to discuss the most desirable features of a piggery, and then let each man adapt his building to his own particular requirements.

The most important features that should be embodied in a practical hog house are durability, dryness, ventilation, light and sunshine, freedom from draft, reasonable warmth and convenience. The construction must also be such that the building can be kept sanitary and free from vermin.

Durability.—Not infrequently the mistake is made of putting up flimsy structures that at best can only last for a year or two. Where not absolutely necessary, and it is not often that such is the case, this policy is in the long run very poor economy. The house must be replaced every few years and in a short time sufficient money has been expended in rebuilding and repairs, which if taken in the beginning would have been sufficient to construct substantial quarters. There has really been no saving made and beside one is continually hampered by the inconveniences of flimsy-built buildings. Well constructed buildings are one of the greatest assets to successful hog raising.

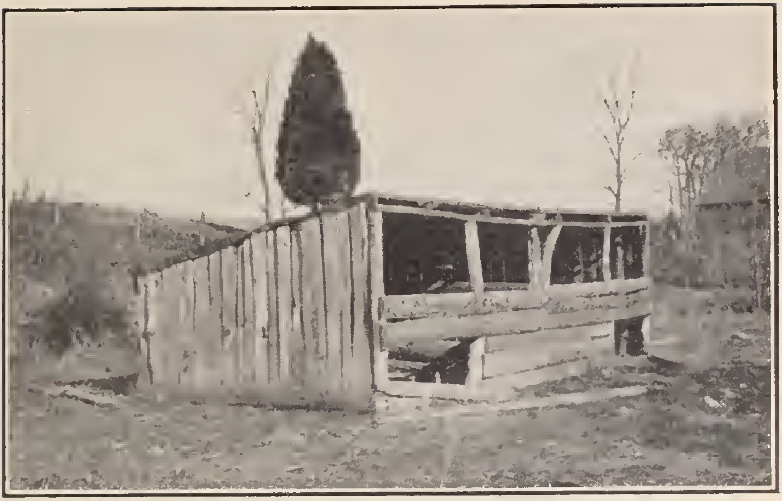

Fig. 1.—Cheap sleeping quarters for hogs on pasture.

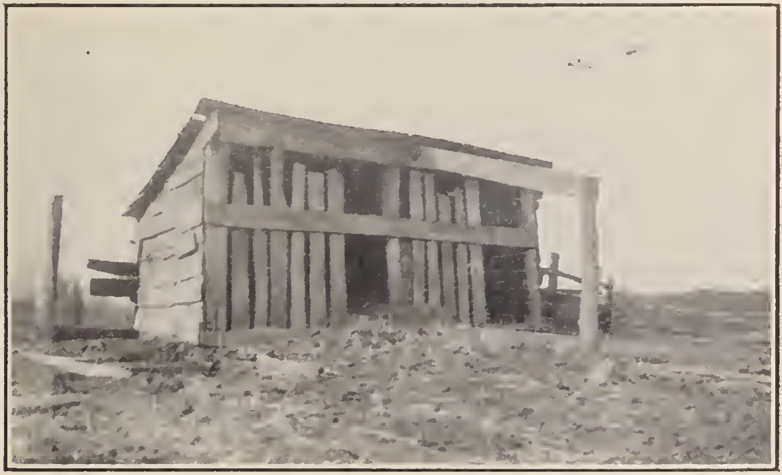

Fig. 2.—Permanent hog pen on a Southern Maryland farm.

Dryness.—The problem of keeping the house dry (may be largely met by proper ventilation), but there are at the same time other factors such as location and the materials used in construction that must be taken into consideration. Regardless of the type and size of the building, it should never be located on low, poorly drained land. Not infrequently a rather high location will require some underdraining with tile before a suitable site can be obtained. If stone or cement are used for the floor and foundation walls, care must be taken to see that the underdrainage is sufficient to keep them dry. If the walls and floor are damp and dripping with water during the cold weather trouble may be looked for. Cement or board walls having a dead air space in the center are probably more desirable than the monolithic construction, but when properly constructed the latter will prove very satisfactory.

A splendid combination where cement is used is to have the floor and walls to a height of two or three feet made of this material, the remainder of the walls being constructed of lumber and sealed inside and out so as to make a dead air space.

When the house is constructed of lumber throughout good walls may be obtained by first boarding the studding inside and out with rough boards. The outside can then be clapboarded and the inside wall first covered with tar or building paper and then tightly sealed with matched material. A saving may sometimes be made by using a good grade of roofing paper instead of clapboards on the outside. The floor must be high enough from the ground to insure dryness and sufficiently tight to keep the air from drawing through.

In some of the older piggeries we often find a loft floor of poles covered with several inches of straw, the idea being that the moisture in the air will be absorbed by the straw. In some cases this plan has given very good satisfaction, but the tendency of late years has been to discard the loft and leave the interior entirely open to the rafters. In the latter case the rafters are ceiled on the inside to keep the room from being too cold.

Ventilation.—As as been previously mentioned, ventilation is an important factor in keeping the house dry, yet at the same time too much exposure may become a serious drawback by unduly lowering the temperature. Various schemes and appliances for ventilating large hog houses have been advocated from time to time by different authorities, but when applied in actual practice the majority of them have proven to be more or less unsatisfactory. Shafts, chimneys, cupolas, etc., will work under certain positive conditions, but the writer does not believe that the average farmer would attempt to utilize them in the construction of the hog houses for his herd. In only a very few specific cases will very large houses be built and even in such event the owners of these will usually make a careful study of the proposition before drawing the final plans. It is then with the more simple methods of ventilation that we are primarily interested in the present discussion.

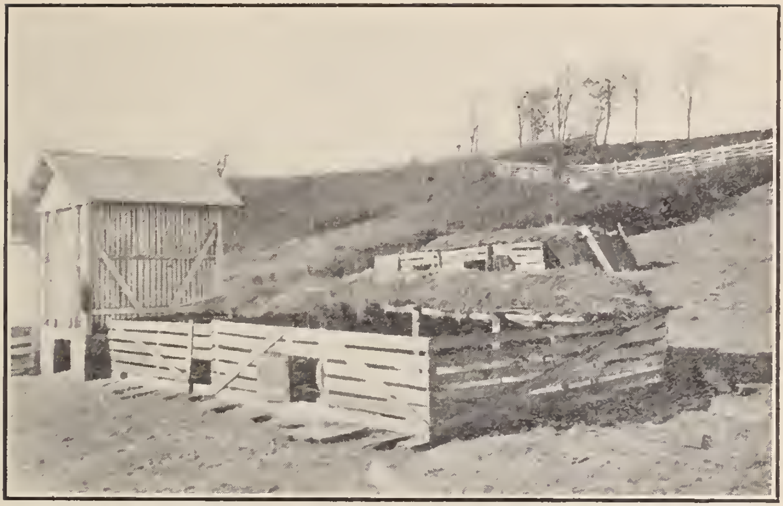

Fig. 3.—Straw used as roofing material for hog shelter.

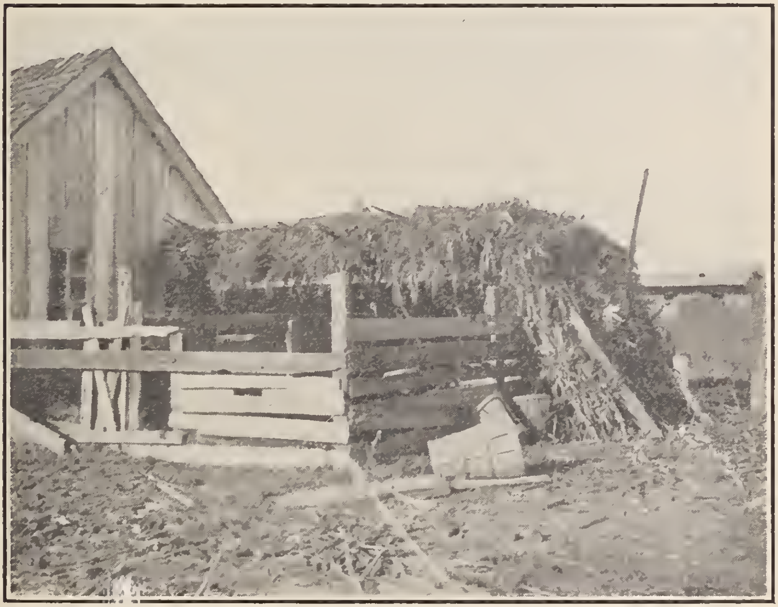

Fig. 4—Corn fodder used as roofing material for hog shelter.

In the small portable hog cots (such as the A-shaped herein illustrated) and the shed roof types, ventilation is usually provided through the windows and hog doors. In the A-shaped cot it will be noticed that there is a small window just above the entrance door. This is used for ventilation during the warm months and for supplying sunshine during the winter. An inverted V-shaped trough arrangement is so placed over the ridge that a small space on either side is left for additional ventilation. In summer the hog doors in either end of the cot are removed or propped open so as to permit the maximum amount of circulation. During the cold months one of these doors will be tightly closed and the other covered with a burlap sack or a similar piece of material, the small window kept closed and ventilation supplied through the door covered with burlap and through the small openings on the ridge.

The methods of ventilating the A-shaped cot have been described because they illustrate the important points in ventilation. For example, in summer it is important to have an aboundant supply of fresh air—this is well provided for by the doors in either end of the cot, the window, and by the opening at the ridge. Again in the cooler weather we want plenty of fresh air without drafts striking the pigs. The closing of the rear door and front window, leaving but one opening in the front or south end makes this possible. In bitter cold weather the hanging of a piece of burlap over the entrance door gives additional protection without interfering with the ventilation.

The vital point with all ventilating arrangements is to supply a rapid movement of air in the summer by having several openings and a more or less indirect change of air in winter through a single opening. Currents of air are harmless in summer but rather dangerous in cold weather. A single large opening in the south wall of the piggery with the end and back walls of the building tight is the most satisfactory and practical method of winter ventilation.

Light and Sunshine.—Pens which admit an abundance of sunshine are a direct aid in growing strong, sturdy pigs. Sunshine seems to have a wonderful influence in promoting health. It is Nature's best disinfectant and helps to keep the quarters dry and warm. It is very essential then that the building be so constructed that an abundance of its health-giving rays may flood the floor and walls. The openings in the south wall of piggeries shown in Figures 6, 7 and 8 are so arranged that an abundance of sunshine is supplied during the cold winter months. The important point is to have the openings and windows high enough for the sunshine to strike the farrowing bed during the greater part of the day. In low shed roof buildings such as are generally used for the average farm hog house this is easily accomplished by leaving the greater part of the south wall open (see Figures 6, 7 and 8). For those who may desire to construct very large hog houses, the writer would recommend that they procure a copy of Farmers' Bulletin No. 438 of the United States Department of Agriculture. Mr. Warren, the author of the bulletin, has carefully worked out a series of tables based on latitude, that give the correct placing of the windows, for securing the greatest amount of sunlight for all sections of the country.

Drafts.—This point has been thoroughly discussed under the head of ventilation and all that we will add at this time is to repeat the warning that the house must be constructed so as to avoid direct currents of air striking the pigs during cold weather.

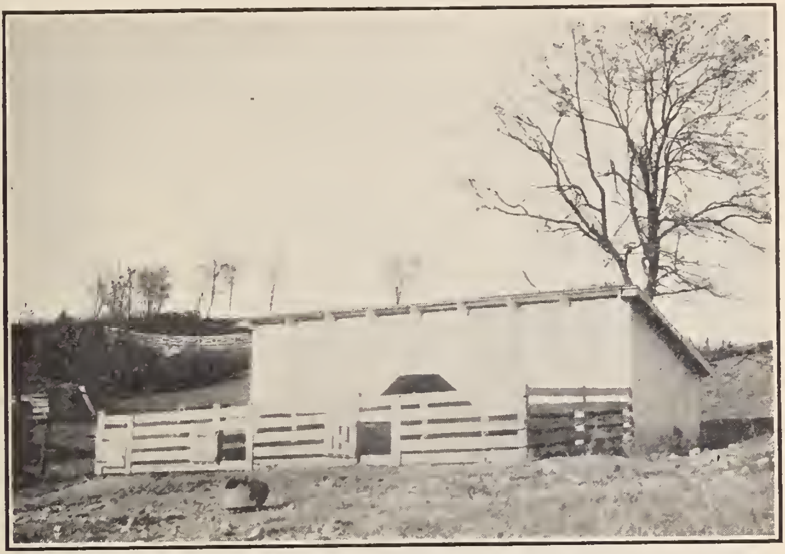

Fig 5.—Well-built piggery with the exception that openings are too low.

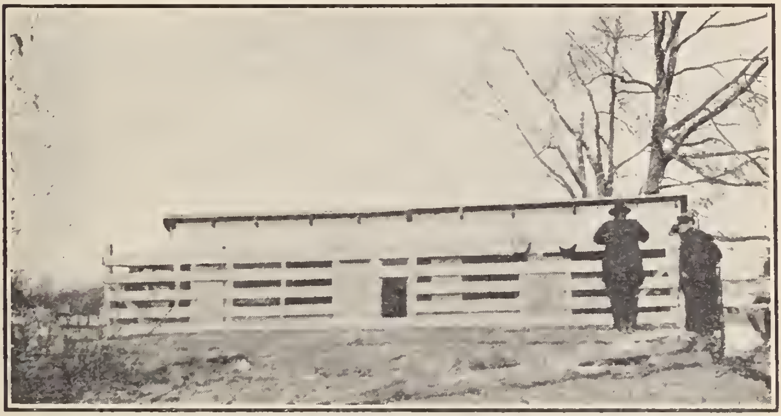

Fig. 6.—A practical, economical piggery for farm conditions.

Warmth.—Warmth is a very desirable thing, but it must never be secured at the expense of ventilation. In other words, dry, cold houses are far mode conducive to good health than warm houses where the air is damp and foul. If the openings in the south wall are of sufficient size and properly planned to admit sunshine little difficulty will be experienced in keeping the quarters comfortable for mature pigs. If, however, the sows are permitted to farrow during the winter it will often be found necessary to hang lanterns from the ceiling in order to keep the young pigs from becoming chilled during the very cold weather.

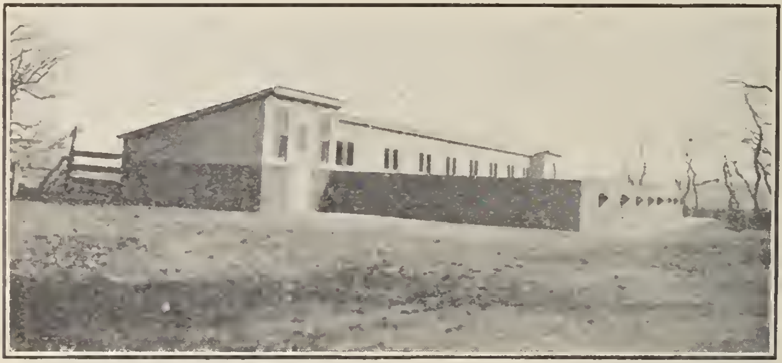

Fig. 7.—New cement piggery at the Maryland Experiment Station.

Fig. 8.—Another type of practical piggery, showing the south side of cots entirely open for sunshine and ventilation.

Convenience.—This is a factor that is often overlooked in building the hog house. One of the most glaring faults of small piggeries is the absence of proper sized doors for the attendant's use. The house shown in Figure 9 is an excellent illustration of this point. To enter the house one must get down on his hands and knees and crawl through the small pig door. Those who have attended cross, nervous sows at farrowing time can well appreciate the great disadvantage of such construction. A much better plan would be to make the door in two parts and as high as the top of the window. The window could be placed in the upper half and when this was swung open the attendant could then enter the pen by simply stooping a trifle. Attention to these little details often tends to make one's work more pleasant.

Sanitation.—We have long since recognized the fact that the practical management of diseases lies in their prevention. The construction of the hog house and the care given it have much to do in preventing diseases. If the suggestions previously given are carried out it will be an easy matter to keep the house in a sanitary condition. Small dirt yards in connection with the piggery are one of the most common causes of infection. It is very difficult to clean them and during the fall and winter months they become belly deep in mud and filth. If it is necessary to use small yards do not have them of dirt but use instead cement, brick, boards or logs or any other material that will provide a solid bottom and permit frequent cleaning. The expense involved is very slight and the chances of keeping the animals free from disease are far better than under the former conditions.

Another common mistake that is often made is the use of straw and fodder as a covering for the pig pen. Figures 3 and 4 are typical illustrations of this practice. The writer fully appreciates that thousands of good pigs have probably been raised in just such structures, but he would also call the reader's attention to the fact that millions of people are annually exposed to contagious diseases which they manage to escape. The point at issue is not how far can we venture toward the danger line without serious results, but rather how thoroughly can we protect our animals within reasonable limits so as to avoid outbreaks of disease. The use of fodder and straw as covering for the piggery opens the way for lice and vermin to secure a good foothold and we must remember that these pests have no part in the successful growing of hogs. Not only does such a practice invite trouble, but it is also a waste of perfectly good feed.

Miscellaneous Hints on Building.

Serious objections are often made against stone and cement floors because they are cold, damp and rather hard on the hogs' feet. While there is more or less truth to these objections they can easily be overcome by the use of a false floor. Such a floor should be raised at least an inch from the concrete by nailing cleats on the under side and spacing the timbers of which it is made one-half inch apart to permit drainage.

The use of whitewash on the interior of the house is an excellent practice. It is a fairly good disinfectant and also helps to increase the light very materially. When the sunshine strikes a whitewashed wall much of it is reflected to the floor and does considerable good. If dark houses must be used for the pigs they can be very much improved by whitewashing.

Always have the hog house stand east and west and face the south. Such a plan insures the greatest amount of sunlight during the winter.

Regardless of the type or size of the hog house it should always be provided with a pig rail or "fender." Unless some such protection is provided for the young pigs, heavy sows are very apt to crush them when they lie down to rest or to nurse. A good pig rail is made by taking inch by ten boards and securing them in position about ten inches from the floor. These boards when in position look exactly like shelves. The ten-inch projection which they afford keeps the sow from lying up close to the wall of the house.

If partitions are used in the hog house for farrowing purposes, arrange them so that they may be easily taken out and the house changed into one large pen.

If dirt floors are used make it a point to stretch electrically welded corn-crib wire over the surface. Such a plan keeps the hogs from rooting and gives protection against rats. Always raise a dirt floor high enough above the outside ground level to insure dryness.

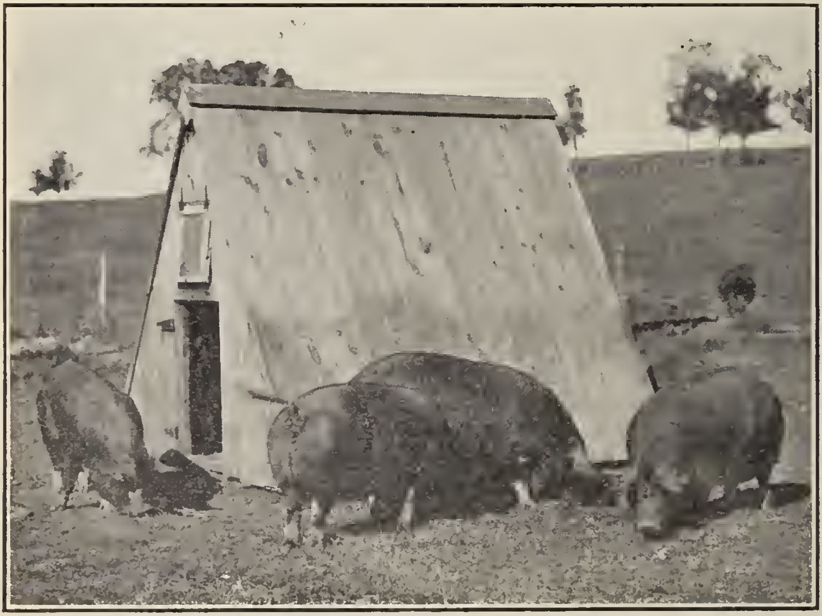

Fig. 9.—A-Shaped house in use on large pasture.

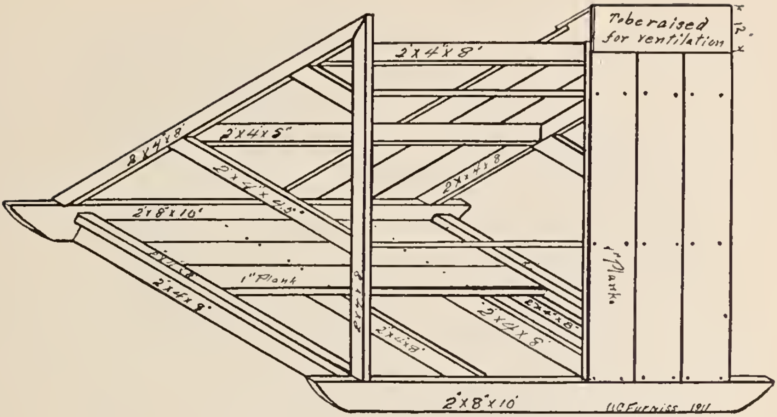

Fig. 10.—Portable Farm Hog Houses—Modified Lovejoy Type.

Originality is not claimed by this station for the general design of this hog cot. The portable hog cot in several styles has been in use for several years by some of the experiment stations and some well-known hog breeders. The Illinois, Wisconsin and Michigan Experiment stations especially have taken an active part in designing and improving this kind of hog house. The chief advantages of the portable hog cot are that it can be moved from place to place, that it is comparatively inexpensive, and that each hog or bunch of hogs can be given a separate shelter. The portability makes possible the isolation of sick hogs, the sheltering of hogs on temporary pasture and the removing of the cot if the surroundings become unsanitary. The size of the hog cot makes it easier to warm with the body heat of the animals and also reduces drafts.

The cot shown in Figures 9 and 10 has proven satisfactory at this station. The whole of the frame is made of 2-in. x 4-in. scantling, except the runners at the sides, which are 2-in. x 8-in. The floor which is separate from the rest of the cot is made of inch-boards nailed on 2-in. x 4-in. cross pieces. The ends and roof of the cot are covered with inch-boards. The whole outside of the cot may be covered with roofing paper in which case rough lumber can be used and the width of the roof boards is not important. But if no roofing paper is used the roof should be made of wide boards and the cracks covered with strips. In each end of the cot is a door 2-ft., 4-in. high and 2-ft., 10-in. wide hinged at the side to open outward. The door in the north end of the cot may be hinged at the top if preferred. Fenders to prevent brood sows from overlying pigs at farrowing time may be made by placing two 1-in. x 10-in. boards on edge eight inches from the floor and lengthways of the cot, with about four feet between them. These fender boards should fit into slots at the ends so that they may be removed when not needed. Ventilation is provided by raising the two wide boards placed in the shape of an inverted trough over the comb of the roof.

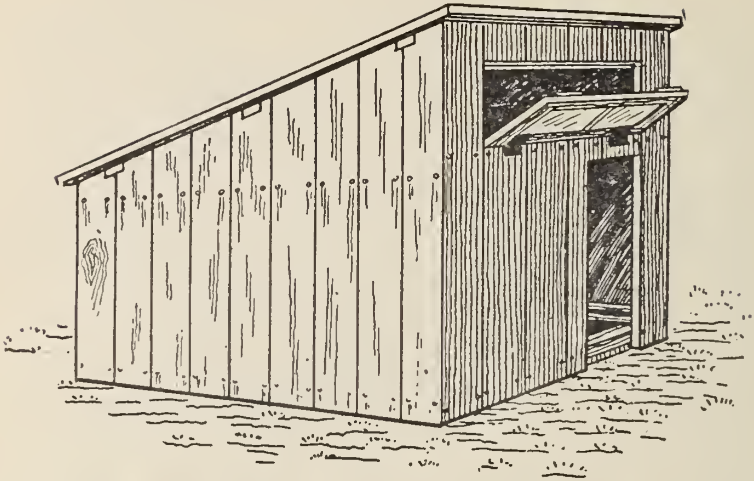

Fig. 11.—V. S. Farmers' Bulletin 411.,

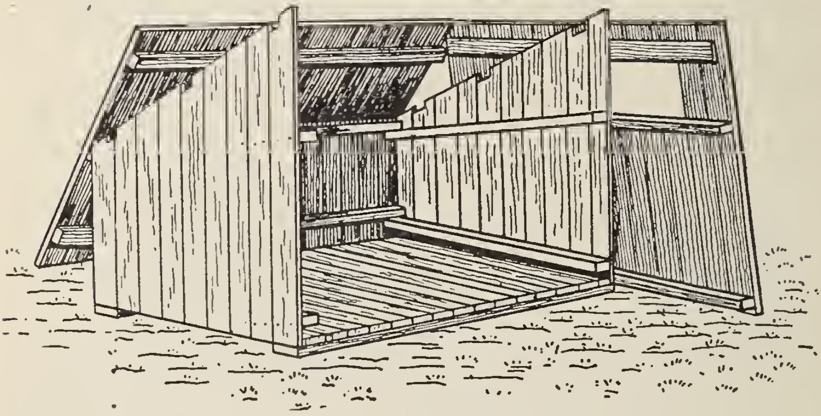

Fig. 12.—V. S. Farmers' Bulletin 411.

BONHAM HOUSE.

In Figures 11 and 12 are shown two views of the Bonham portable hog house. The dimensions of this house are five feet high in front and 3 fet high in the rear, and a floor space 5 feet by 6 feet. It rests on sills of 2-in. x 4-in. material and the frame for the sides and roof are of similar material. Inch boards are used throughout for covering and also for the floor. As will be noted in Figure 11, there is an opening 2 feet wide and 3 feet high in the front wall. This is used as a doorway but no door is provided. Just above this opening provisions are made for a window 10 inches wide and 24 inches long. It is hinged at the bottom and is operated with a cord which makes it possible to secure it at any angle when open.

The openings between the roof boards should be carefully battened so as to prevent the rain from coming through and the whole house well painted so as to increase its durability. A structure of this kind is of course intended for use during mild weather, but if the lower opening is covered with a burlap curtain and a lighted lantern suspended from the ceiling the house can be made very comfortable even in cold weather.

One of the very simplest shelters with which the writer is familiar is what is known as the Spillman house. It is 8 feet long, 5 feet wide, 3½ feet high in front and 2½ feet at the back. The entire front side is open and no floor except the natural earth is used. This shelter is used primarily for sheltering sows from the sun and rain when they are turned out in a large pasture field. When provided with pig rails or fenders it may also be used for farrowing purposes during the warm weather. It is frequently used as a shelter for the sow and pigs after the youngsters are two or three weeks old.

FEEDS AND FEEDING.

General Notes on Feeding.

Feeding the hog from birth to maturity is the one question that has received the greatest amount of attention at the hands of swine investigators all over the country. The experiments and tests conducted and the results obtained cover such a vast field that it is absolutely impossible to review them in connection with the present bulletin, and the subject has therefore been treated in a general way only. However, those practices that have been inaugurated as a result of the most important of these tests have been included in the general subject matter.

It seems needless to say that the feeding of swine should receive much consideration from the Maryland hog raisers and yet a study of the farm pig feeding shows that little or no attention is given to the important phases of this work. The need of different rations for various periods of the hog's life seems to be little undrstood by the average farmer. This is especially true in reference to those periods when a certain proportion of those feeds rich in protein are most essential to proper growth and development. Again, the value of forage crops in connection with the feeding of grains and concentrates seems to have been entirely overlooked. Not only are the important points of correct feeding overlooked, but many hog raisers seem to try to convince themselves that the hog is an animal to which unwholesome or spoiled food can be fed and that such feed will be digested and assimilated by the animal. While it is true that the hog is an omniverous animal, the results of practice show that its feed should be selected with care and be wholesome and palatable. Such a statement, however, is not meant to convey the idea that clean, unspoiled waste and refuse from the kitchen should not be utilized as a part of the hog's ration.

Slop or clean garbage when rightly handled is one of the cheapest and best feeds that the writer has knowledge of for growing and fattening hogs. In fact, several very large hog farms in different sections of the country are being conducted almost exclusively on this class of food, and during the past year the swine department of the Maryland Agricultural Experiment Station has been utilizing the waste from the College kitchen with splendid results for feeding a part of its herd. The feeding of slop and garbage that is partly spoiled, however, is very liable to be followed with disastrous results. The presence of soap powders and similar commercial cleaners in the slop is another source of heavy mortality in swill-fed pigs and swill or garbage containing them should always be strictly avoided.

Another common mistake made by inexperienced feeders is the feeding of moldy grain to the hogs. Such feed is dangerous to all animals and the hog is no exception. The feeding of soft immature corn that has been frozen is also likely to cause sickness and not infrequently deaths in the herd. While it is the hog's business to utilize as much of the farm waste as possible, we should not expect him to transform worthless and dangerous feeds into healthy flesh.

There are some damaged grains that may be used as hog feeds very successfully. In experiments conducted with frozen wheat at the Ontario Agricultural College it was found that the product had a feeding value equal to barley when it was fed in connection with middlings. Another product that may often be purchased very cheap is what is known as blackened grain. If not properly cared for when going through the sweat such grains as wheat, oats, barley or rye will be slightly blackened or charred and damaged for the usual commercial purposes. Such feeds are perfectly wholesome for swine and may often be used to very good advantage as substitutes for the more expensive products.

The hog's food should not be too bulky as the anatomical conformation of the animal is such that he cannot handle foods of this character to advantage. While it is a recognized fact that the hog consumes more food in proportion to his weight than any other farm animal, it behooves us to bear in mind the necessity of providing food for him in a good mechanical condition and of a sufficiently palatable nature to maintain his appetite. Excessive amounts of roughage should therefore be eliminated from the hog's ration, for if we persist in feeding extensively on this class of food the gains made will be very unsatisfactory.

One very important point in the feeding of hogs is to have suitable feeding troughs and floors and to keep them clean and sanitary. For the latter purpose there is nothing better than concrete. Iron and steel troughs are also very good but more expensive than the former. Care must be exercised to see that feed does not remain in the troughs after the hogs have finished eating. Lack of attention on this point may cause trouble and sickness in the herd from eating the feed after it has become moldy or sour.

Grain Feeds.

Of the grains used in swine feeding corn is the most important of all. Its adaptability to a wide range of climatic conditions and its splendid fattening qualities are largely responsible for its popularity. Hogs seem to thrive and do well when corn is used as a part of their ration. As an exclusive diet, however, we find that the results are not so satisfactory. The general tendency for farmers to use this grain almost exclusively for feeding hogs has led several experiment stations to conduct tests as to the relative merits of an exclusive corn diet. An average of the results of such tests conducted at thirteen different stations shows that it requires 580 pounds of corn to produce 100 pounds of gain. With corn at 40c the hundred pounds gain costs $4.15; at 50c, $5.18; at 60c, $6.21, and at 70c, $7.25. With corn at 70c per bushel, the feeder must get at least seven cents per pound for the pork in order to nearly break even, and in this event he receives nothing for his trouble and labor. At the present prices of corn and pork the feeder might break even or make a slight profit on corn-raised pigs, but when we consider what profit is possible through the use of some feed supplementary to corn, we can readily see that one is not justified in feeding corn alone, even if a small profit is possible.

Fig. 13.—Proving that proper nourishing of the mother pays, and pays well.

At the Alabama Station it was found that a ration of one part corn and two and two-tenths parts skim milk produced 100 pounds gain at a cost of $4.02. At the Tennessee Station a ration of one part corn and four parts skim milk produced 100 pounds of gain at a cost of $4.56. In both cases corn was selling at 70c per bushel. Compared with the average cost of producing 100 pounds of gain on an exclusive corn diet, as given in the preceding paragraph, we find that the addition of from two to four parts skim milk to the ration reduced the cost of 100 pounds gain approximately $3.00.

At the Indiana Station a ration of 6.5 parts of corn meal and one part linseed meal produced 100 pounds of gain at a cost of $4.95. In this test corn was worth 70c per bushel and linseed meal $30.00 a ton. In another test at this station a ration of equal parts of corn and middlings produced 100 pounds of gain at a cost of $4.75.

At the Nebraska Station a ration of nine parts corn and one part digester tankage produced 100 pounds of gain at a cost of $4.27.

Numerous other tests might be cited, but those mentioned clearly indicate that the addition of a supplementary rich protein feed to the corn diet is essential for the most profitable utilization of the corn.

Of the small grains wheat, oats, barley and rye are used to a limited extent where they can be purchased at a price low enough to justify their use as a part of the hog's ration. Buckwheat is also fed in those localities where it is raised extensively. These smaller grains are not so fattening as the corn and are better adapted to the growing of bacon hogs.

BY-PRODUCT FEEDS.

Many of the grain by-products are employed extensively as swine feed. Those in most general use are bran, middlings, shorts, gluten meal, gluten feed, brewers' grains and buckwheat middlings. Other minor by-products such as oat hulls, rice hulls, buckwheat hulls, etc., are sometimes used in swine feeding, but on account of the large amount of crude fibre present in them they are of little value for this purpose. The important by-products are used in various combinations or as a supplement to a corn ration and are well adapted to swine feeding.

Some of the packing house by-products such as tankage and meat meal are very extensively used in swine feeding. The use of either of them in connection with corn cheapens th ration and makes corn worth more a bushel as a hog feed. In practically all the experiments where tankage or meat meal have been added to the corn, the cost of producing gains has been considerably lower than when corn was used alone. In an Alabama test it cost $7.19 to produce 100 pounds of gain on corn alone. When a ration of nine parts corn and none part tankage was used, this cost was reduced to $5.18, a gain of $2.00 over the exclusive corn diet. At the Tennessee Station only 18.7 cents was realized from a bushel of corn when used alone, but when meat meal was added to it, the gain secured increased the value to 50.3 cents.

Cottonseed and linseed meals are quite frequently used as supplementary feeds with corn. They are both very rich in protein and must therefore be used with caution in connection with swine feeding. In such tests as have been made it has been found inadvisable to use cottonseed meal in the ration for any great length of time. If it comprises one-third of the ration, 21 days is the maximum period in which it should be given; when it is desirable to include it in the ration for a longer period, the proportion should be reduced to one-fifth or one-sixth, and even then there is some danger. It is thought that the liberal use of succulent feed, such as pasture, will tend to lessen the danger from the extended feeding of this product.

Experiments carried on at the Alabama Experiment Station showed a cost of $7.38 per hundred pounds of gain on an exclusive corn diet, while a ration of two-thirds corn and one-third cottonseed meal produced 100 pounds of gain at a cost of $5.75. Additional tests at other stations show a corresponding saving by the use of cottonseed meal with a ration of corn.

Linseed meal when used with corn in the proportion of one to five gives a very low grain cost per 100 pounds of gain. At the Missouri Station a comparison of the above mixture with a ration of corn meal and middlings showed a difference of 37c per 100 pounds gain in favor of the corn and linseed meal. The cost in both cases was low—for the linseed meal ration, $3.23, and for the corn meal and middlings, $3.60.

Soybean meal when used in the proportion of one to two with corn meal has proven to be an excellent feed for swine. In feeding value it is similar to linseed meal. The ever-increasing demand for the seed, however, has advanced the price of these legumes until it is rarely profitable in most localities to utilize them as a part of the grain feed.

As has already been pointed out, the dairy by-products, such as skim milk are among the most valuable supplementary feeds that are available on the farm. Their use in connection with corn and grain feeding cheapens the ration and results in very satisfactory gains. They are likewise ideal feeds for the brood sow and her litter, for their is nothing outside of the mother's milk that will give a young pig a better start.

Some of the various root crops and succulent feeds such as sugar beets, artichokes, carrots, potatoes, silage, pumpkins, etc., are often used to advantage in pig feeding. Such feeds, however, are adapted more especially to winter feeding when natural forage and succulent green food is not available. They have no particular fattening qualities, but are valuable for adding bulk and for keeping the digestive organs in good condition.

PASTURAGE.

In these days of high-priced corn and other foodstuffs we often hear the expression that it does not pay to market the corn through the porker. It is held by many, whom we are certain have never carefully studied the situation, that when the current price of corn and the natural risk from disease are considered, one is far more likely to get greater returns by selling the corn than would be possible by converting it into hams and bacon. Such a statement would be more or less truthful if made in connection with dry lot feeding and fattening, but when made in connection with good pasturage it will be found difficult to substantiate. The numerous tests that have been made in relation to the value of forage crops as cheap pork producers show that practically all of them are extremely valuable to the hog growers.

Before entering into a discussion of the value of the various forage crops available for hog pasture in Maryland, it will be well to say a few words concerning the important position blue grass occupies as a forage for swine. In various tests which have been made with blue grass as the chief forage crop, it has been found that the average number of days pasture supplied was 165, which in itself is a point of considerable advantage. The average number of hogs per acre in the above figures varies from 10 to 12. In connection with the blue grass pasture, as well as with all other forms of forage crop, it is imperative that a certain amount of grain food be fed daily. In one test with this pasture a grain ration of six parts corn and one part linseed meal produced a total gain of 1,645 pounds, the amount of grain feed being 7,392 pounds. An allowance of one pound of pork for every 5.6 pounds of grain (this being the average amount that is put in the dry lot feeding) will leave an average gain of 324.6 pounds to be credited to the forage. Expressed in other words, each pound of pork produced on blue grass pasture required, in addition to the grass consumed, only 4.5 pounds of grain as contrasted to 5.6 pounds required to produce one pound of pork by dry lot feeding. The average value of the pork produced by an acre of blue grass was $19.47, with pork selling at 6c. At 7c a return of $22.71 was effected, and $25.96 with a price of 8c.

The writer is very much inclined to believe that with the exception of four to six weeks during mid-summer, blue grass provides as good a pasture if not better all round forage for swine in Maryland than any other single forage or combination of forage crops that might be worked out. A strong point in favor of such an argument is the fact that in many sections of the State the farms are operated so that the pasture field has a consistent position in the regular rotation.

Cowpeas and soybeans are two of the most valuable forage crops for hogs that are available to the Maryland farmer. Of the two, soybeans is probably the better. In fact, for this purpose it is better than any other legume crop grown in Maryland. The beans are greatly relished by the hogs and experiments have shown that where the production of 100 pounds of pork cost $7.63 when corn was fed alone, the cost was reduced to $2.74 per 100 pounds when about one third of the ration consisted of soybean pasture.

In harvesting the crop with porkers it is best to wait until the pods begin to ripen before turning them into the field. For best results the beans should be planted in rows, since the loss from tramping will be less than when planted broadcast. One acre will furnish feed equal to about 1,500 pounds of corn. At the Alabama Station a half ration of corn supplemented with cowpea pasture produced 100 pounds of gain at a cost of $3.84. The same amount of gain on corn alone cost $7.33.

Fig. 14.—The results of good pasture and proper grain feeds.

The red, crimson, alsike and mammoth saplin clovers are all splendid early spring forage crops for hogs. The red clover is probably the best and the one that is most extensively grown in this State. The crimson is available only for a very short period while the other three will continue to send up new shoots during the greater part of the growing season. The value of the red clover is well illustrated by the following paragraph from the Missouri Bulletin No. 95.

"An average of 11 head of hog were pastured for an average of 130 days for the seasons of 1908 and 1910, and produced an average of 572.2 pounds of pork that could be accredited to each acre of forage eaten. With pork at 6c there was returned from each acre of forage an average of $34.11; with pork at 7c, $39.28; or with pork at 8c, $45.51. These experiments indicate that a value of 98 cents may be obtained for each bushel of corn fed to hogs pasturing in clover, when pork is worth six cents, and when rent of land, taxes, labor, etc., are valued at $10.00 per acre."

Alfalfa and rape are two of the most valuable forage crops known for hogs. Their position in the hog forage crops of Maryland, however, is not as important at the present time as those which have already been discussed. As the eastern farmers become better acquainted with their production it is quite likely that they will equal if not surpass those crops that are now so widely grown for forage.

In making his survey the writer found several farms on which alfalfa was being used extensively as a forage for hogs and in every case the owners were very enthusiastic over the results obtained.

Rye may be considered among the important forage crops for hogs since it furnishes excellent pasture during the fall, winter and early spring. Quite frequently the grain is allowed to ripen and the hogs turne in to harvest the crop. The returns per acre by this method, however, are somewhat lower than those of the more important forage crops. At the Missouri Station it was found that with pork at 6c, corn at 60c per bushel and oil meal at $30 per ton, the returns from an acre of rye equaled $14.60; with pork at 7c, $17.10, and with pork at 8c, $19.54.

A Suggested Forage Rotation for Maryland Hog Growers.

In localities where permanent pastures are not available and also where the farmer wishes to confine his hogs to a specific area of land, it will be found highly desirable to have a series of paddocks or pasture lots available for the animals. The plan and the rotation suggested below is especially adapted to Maryland conditions and is arranged with a view of providing some form of forage during the greater part of the year.

The plan calls for three paddocks or lots of one or more acres each, depending on the number of pigs to be supplied, ten pigs to an acre being about the maximum capacity. Field No. 1 will be sown to rye any time from September 1 to December 1, depending on the location in the State. Field No. 2 will be sown to Alsike and red clover during the latter part of July or the early part of August, and Field No. 3 will be sown to sorghum between May 15 and June 1.

Field No. 1 is available for forage the next spring from March 15 to the middle of May or later. The clover in Field No. 2 is then available and the pigs are transferred and kept in this pasture until the latter part of July. The sorghum in Field 3 is then ready and the pigs are turned into the field and pastured until the soybeans or cowpeas are ready. The soybeans or cowpeas will have seen sown in Field 1 between June 1 and July 15, and will provide excellent forage for finishing off the hogs from September 1 until the early part of December.

A very important point that must not be lost sight of in connection with forage crops for hogs is that the best of them is nothing more than a maintenance ration, and to derive the greatest benefits from their use it is absolutely necessary to feed daily a substantial grain ration. A safe rule to follow as regards the amount of grain necessary with forage crops is to provide grain to the extent of from 2½ to 3 percent of the weight of the hog. If leguminous forage crops such as clover, alfalfa, cowpeas or soybeans are used the grain ration may be entirely of corn, but if the animals are pasturing on blue grass, sorghum, rye, oats or wheat the grain ration should be balanced by the addition of oil meal or tankage. Good rations for the latter conditions would be six parts corn and one part oil meal or five parts corn and one part tankage.

FEEDING THE BOAR.

The young boar like all growing animals needs nitrogenous food to develop his vital organs, muscle and bone, while the mature male can be maintained on a more or less starchy ration. The rations suggested for the young pigs are well suited to the immature boar. The mature boar should be kept in fairly good flesh but never fat. If allowed to become fat he is apt to be sluggish and prove a poor breeder. During the summer give him access to a good pasture and allow him from one to two pounds of corn a day and a little bran or middlings slop. During the breeding season the feed should be increased sufficiently to keep him in prime condition. Weak sires cannot be expected to throw large strong litters. During the winter months provide a roomy yard for exercise and feed a rather bulky ration. Such feeds as corn meal, bran, alfalfa or hay are good and should be supplemented with a few roots to keep the appetite keen and help regulate the bowels.

FEEDING THE BROOD SOW.

When a sow is producing two litters a year there is seldom a time when she is not doing double duty. During the period of gestation she must keep up her own bodily functions and in addition supply the nourishment for the development of the fetal litter. After farrowing the drain upon her system in providing feed for the young pigs, is even greater than during the period of gestation and we should therefore be able to appreciate the necessity of supplying her with the proper amount of suitable rations at all times.

Summer feeding during the period of gestation should consist of good pasture and a variety of concentrated grain rations. For the latter the following mixtures are recommended:

1. Four parts of milk by weight and one part of corn.
2. Five parts corn meal, five parts middlings or ground oats and one part digestor tankage.
3. Equal parts of shorts and corn.
4. Eight parts of corn and one part of digestor tankage.
5. Six parts of corn and one part of oil meal.

If the sows are to be fed entirely on grains the following mixture is recommended by the Wisconsin Station: Corn meal, 23 pounds; ground oats, 23 pounds; wheat middlings, 23 pounds; wheat bran, 23 pounds; oil meal, 6 pounds; salt, 2 pounds; total, 100 pounds. This should be fed as a slop.

The winter feeds of pregnant sows should consist largely of bulky foods such as milk, roots, clover or alfalfa hay, and enough of the above grain rations to keep them in good condition.

During the first 36 hours after farrowing the sow should receive nothing but plenty of water, luke warm in cold weather, to which may be added a very small amount of middlings. When the sow is given liberal quantities of rich food just after the pigs are born a strong flow of milk is forced. The young pigs get too much, causing diarrhea and not infrequently death. It is impossible for them to utilize all the milk and the sow's udder consequently becomes caked and inflamed. This condition becomes so painful that the sow will often jump up and kill and eat the pigs when they attempt to nurse. After the first 36 hours the feed may be gradually increased until at the end of eight or ten days the sow is on full feed. Such rations as equal parts of ground oats and middlings mixed with skim milk, or corn and liberal quantities of skim milk, may be given while the pigs are with the sow. After the second week give the sow and pigs access to good pasture in addition to the grain feeds. As the pigs increase in size the quantity of feed given the sow must be increased to meet the demands of the growing youngsters. After the second week and until the pigs are weaned, allow one pound of grain feed per hundredweight of sow per day as a maintenance ration. For each pig during the third week feed 3 pounds additional; for the fourth week, 6; for the fifth week, 8; for the sixth week, 1 pound, and for the remainder of the time from one to one and a quarter pounds.

The pigs may be weaned when about eight weeks old and at this time the sow's feed should be cut down to check the secretion of milk. Dry oats or similar feeds are suitable for the sow for a few days after the pigs are weaned.

FEEDING THE YOUNG PIGS.

Before the pigs are weaned they should be taught to eat a little feed in addition to the milk furnished by the mother. After they are three or four weeks old the little fellows will begin to nibble at things and can then be given a little shelled corn to crack. About this time they should be provided with a trough so placed that the larger hogs cannot get to it. Give them all the milk they want or a medium thick slop made of two parts corn meal, seven parts wheat middlings, one part tankage and thirty parts skim milk or water. After weaning the pigs should be put on good pasture and supplied with one of the following rations until time to fatten and finish them for market.

RATIONS FOR GROWING PIGS.

1.

30 pounds corn meal.
30 pounds ground oats.
30 pounds wheat middlings.
8 pounds oil meal.
2 pounds salt.

2.

50 pounds corn meal.
50 pounds middlings.
5 pounds oil meal.

Both of the above mixtures should be fed in the form of a slop and allowed to soak several hours before feeding. The following mixture with variations according to the age of the pigs is recommended by the Minnesota Station:

Weeks after Weaning.	Pounds Water.	Pounds of Grain Mixture.	Grain Mixture Consists of Shorts Parts.	Corn Parts.	Tnkg. Parts.
1st*	16	4.55	6	3	.7
2d	15.5	4.60	6	3	.8
3d	15	4.60	6	3	.8
4th	14.45	4.69	6	3	.9
5th	14	4.73	6	3	.9
6th	13.5	4.80	6	3	.9
7th	13	4.87	6	3	.95
8th	12.5	4.87	6	3	.85
9th	12	4.90	6	3	.8
10th	11.5	4.94	6	3	.7
11th	11	4.94	6	3	.6
12th	10.5	4.95	6	3	.6
13th	10	4.97	6	3	.55
14th	9.5	4.97	6	3	.55
15th	9	5.05	6	3	.5
16th	8.5	5.08	6	3	.45
17th	8	5.10	6	3	.45
18th	7.5	5.10	6	3	.45

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*Week after weaning at ten weeks old.

Plenty of good skim milk and middlings when supplemented by good pasture makes a very satisfactory ration for weaned pigs. After they are three or four months old a little soaked corn or other grains may be added to the ration and the amount gradually increased as the pigs age and develop.

Fattening and Finishing.

The fattening and finishing period should begin when the pigs are from six to six and one-half months of age and should continue for six weeks or two months. During this time the pig should eat a ration equal in weight to 4½ per cent of his own weight at the beginning of the fattening period. Snapped corn and water supplemented with a good forage rich in protein, or with tankage is unexcelled for fattening purposes. By the time the fattening period is over the pigs should weigh from 200 to 250 pounds and be in prime condition to bring the top of the market.

General Management of the Herd.

Aside from the housing and feeding of the pigs there are many other factors in the general care and management of the herd which must be given consideration and attention if maximum profits are to be realized. The discussion which follows has to do with these miscellaneous questions of management, and a study of them should prove helpful to every breeder and grower of porkers.

Correctives.—It is well known among feeders that pigs often crave such substances as wood ashes, charcoal and coal, and while it is not definitely known just what part these substances play in the life of a pig, authorities are practically unanimous in advising the use of some corrective. There are a number of kinds of correctives in use, the most common of which are wood ashes, charcoal, soft coal, coal ashes, lime and bone meal. In many instances salt, sulphur or both are mixed with one or more of the above correctives.

Realizing the importance of a proper corrective for the successful feeding of hogs, this station made a test of the various formulas used and found that the following mixture, known as the United States Government formula, was the most efficacious:

Wood charcoal	1 lb. at	1 cent,	worth $.01
Sulphur	1 lb. at	5 cents,	worth .05
Common salt	2 lbs. at	1 cent,	worth .02
Bread soda	2 lbs. at	1 cent,	worth .02
Sodium hyposulphite	2 lbs. at	6 cents,	worth .12
Sodium sulphate	1 lb. at	3 cents,	worth .03
Black antimony	1 lb. at	15 cents,	worth .15
Total	10 lbs. at	4 cents,	worth $.40

The ingredients given above are carefully mixed together and the resulting composition is fed at the rate of one ounce to every ten pounds of food.

Breeding Crate.—Where a heavy board is used the breeding crate is necessary to protect the small sows from injury. Again, some sows even when in heat, will not take the board readily, and the use of the crate in such cases insure a successful service. A good size for the crate is 6 feet long, 2½ feet wide and about 4 feet high. The frame should be made of 2-in. x 4-in. material. The front is boarded up and the back is left open and fitted with a bar that can be slipped behind the sow just below the hocks. On either side of the sow there should be an adjustable railing for the boar's feet to rest on. In case a small board is used to serve a large sow, the same crate may be used to advantage by simply placing a cleated sloping platform at the rear of the crate.

Hog Bath.—One of the most practical ways of keeping the hogs comfortable and free from vermin during the hot weather is to provide a shallow bathing place. Such a structure is best made of cement and should be about 10 feet square and 12 inches deep. Keep the bath well filled with water and add from time to time a little crude oil, kreso, zenoleum or other similar product to eradicate the lice and keep the skin in good condition.

In case the bath is not possible good results in the elimination of lice may be secured by using a mixture of equal parts of lard oil and kerosene. This may be applied to the hog with a cloth or brush.

Disinfectants.—It is a splendid practice to use disinfectants freely about the hog houses and yards and for this purpose the solutions usually found at druggists will be suitable.

Gestation Period.—It is very important that the farmer should know just when the sow is due to farrow so that proper preparations for her comfort may be made. Young sows generally carry their pigs from 100 to 108 days and old sows from 112 to 115 days. If we take age and condition into consideration the period averages about 112 days. Occasionally a sow will go 116 days, but unless the pigs are immaturely bred she will never go less than 112.

TABLE SHOWING WHEN SOW IS DUE TO FARROW.

Top line of each series is date of breeding; bottom line date of farrow. (Example: Bred January 6th; due April 27th.)*

January	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
April	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	May
February	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	....	....	
May	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	....	....	June
March	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
June	21	22	23	24	25	26	27	23	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	July
April	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
July	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	August
May	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
August	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	September
June	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
September	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	October
July	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
October	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	November
August	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
November	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	December
September	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
December	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	January
October	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
January	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	February
November	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
February	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	March
December	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	3	
March	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	April

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*Texas Bulletin No. 21.

Castrating Young Boars.—For best results the boar pigs should be castrated when about five weeks old. There is no particular danger in deferring the operation, but if done at an early age the wound heals very quickly and there is no danger of stunting the growth of the animal. The main requisites for a successful operation are clean hands, a clean, sharp knife and the liberal use of a mild disinfectant.

Spaying Sows.—From such tests as have been conducted in connection with gains made by spayed and unspayed sows it has been found that there is no particular advantage in spaying.

''At the Utah Station Foster and Merrill secured a daily gain of 0.82 pounds with spayed sows and 0.86 pounds with unspayed animals. No difference in their appetite was noticed.''

Removing Tusks of Boar.—When the tusks of a boar are permitted to become long and sharp he is very apt to cut the sows or seriously injure his attendant when he becomes cross. When they are removed, however, he becomes comparatively harmless. One of the simplest methods of removing the tusks is to cut them off with a sharp coal chisel. First securely snub the animal to a strong post, then place the sharp end of a crow-bar against the tusk near its base. Let one man hold the bar firmly in position while the other places the sharp edge of the chisel on the other side. One sharp blow with a hammer on the chisel will usually cut the tusk off clean.

The Boar.—Without doubt the most important factor in the herd is the boar. Regardless of whether pure bred or grade sows are used, always employ a pure bred boar for service. He should be carefully selected and of a family foreign to that of the sows to which he is to be bred. He should be typical of the breed he represents, well conformed, full of vitality and of a quiet disposition. Always avoid animals with a long head, long neck and long legs. See that he stands well up on his toes. Look out for a sway back or one that is abnormally arched. A fairly straight back is the most desirable. Always allow him to become accustomed to his surroundings before he is put to service.

The mistake often is made of using the boar for service before he has attained the proper age and development. There is, however, no hard and fast rule that can be laid down in this connection. Occasionally we find boars that may be used to a few sows when not more than seven months old without any noticeable injury. A rule which many practical breeders follow is to start service when the boar is about eight months old and then use him as sparingly as possible until he is at least one year old. If the boar is used to any extent while he is immature, it will have a tendency to shorten the period of his usefulness.

Generallly from one to two sows a day are allowed by good breeders, but sometimes in the case of a very valuable boar not more than one is permitted. Where several stock boars are kept it is a comparatively easy matter to regulate the number of services allowed to each individual, but where only one boar is maintained and outside sows admitted for service the problem becomes a difficult one. In the latter case the owner of the boar will have to exercise all his ingenuity to keep his boar from being used too frequently during certain seasons of the year. In either event the boar should not be allowed to run at large with the sows, but should be provided with separate quarters.

When a sow is ready to be bred she should be given one service and at once removed from the boar's pen.

It is imperative that the boar be permitted and in some cases compelled to take liberal exercise. Exercise is the one thing that is most essential to the health and vitality of the animal. In the summer months it can be provided by placing the boar in a good-sized paddock or pasture lot and in winter by providing a roomy pen in connection with a sheltered outside yard.

The boar should be fed so as to be in good flesh at all times and as there is a marked tendency on his part to become fat as he increases in age, it often requires good judgment to keep him in the best possible condition. The animal that is overfat does not make a good sire and neither can a half-starved male transmit vigor to his offspring. The best results then obtain when the animal is in what we would term good, thrifty condition. The chapter devoted to feeding should be carefully studied in connection with the boar's rations.

The Brood Sow.—In selecting the sow to be used for breeding remember, as with the boar, that the best is none too good. Select from large litters with the hope that this desirable characteristic of the mother may be transmitted. If market pigs are to be raised, the sow should be of the best type for meat; thick, deep and growthy. Choose an active rather than a sluggish animal as the former are better foragers and consequently less expensive to maintain. As has been truly said, it is not the price paid for the sow, but what she can do that determines her value as an investment.

As with the boar the age at which a sow is first bred depends primarily upon development. As a rule, however, it is not desirable to breed them under eight months of age and unless the sow is fairly well developed at that age, it will be better to wait until she is 10 or 12 months old. When bred too young they are apt to throw small litters and if only a few pigs are raised the mammary glands are not properly developed and the subsequent litters are very apt to suffer as a result. Again a young sow is not sufficiently strong to withstand the strain of nursing a litter of pigs and her vitality is often impaired to such an extent that she never develops into a profitable mother.

It is not always desirable to breed the sow immediately after the pigs are weaned. If there has been a large litter to support her physical condition is apt to be poor at this time and if she be bred the chances are that the next litter will be small. A few weeks of liberal feeding will build her up and by deferring service until she is in good condition more and better pigs will be secured.

Under general farm conditions where the animals are not bred for the show room the sow should be handled so as to produce two litters a year.

Exercise is of vital importance to the brood sow's welfare and her management should be such that ample opportunity is provided for it. A roomy pasture in the summer and clean, comfortable exercising yards for winter should be supplied. A common practice is to allow the sows the liberty of the barnyard and access to the cattle sheds during the cold months. If the yards are kept well bedded with fodder and straw and the sheds clean and dry the sows will do very well if provided with sufficient food to keep them in good condition. For information concerning the sow's rations consult the paragraph on feeds and feeding.

The New-Born Pigs.—The sow should be carefully watched at farrowing time. If she is inclined to be nervous the pigs should be taken away from her as soon as they are born and put in a box or basket in which there is a vessel full of warm water to keep them from being chilled. In an hour or two the pigs can be returned and allowed to nurse and if they appear strong and active they may be left with the sow. The floor of the farrowing pen should be bedded sufficiently to keep the little fellows comfortable. If the floor happens to be of cement it is best to provide a false wood floor made of slats as the cement is rather cold. As has been previously mentioned, be sure there is a pig rail or fender to keep the sow from crushing the pigs while they are small. It is always best to take the afterbirth away and burn it or bury it, for when the sow is permitted to eat this it sometimes encourages the habit of eating her own pigs.

When just born the little pig's digestive system is full of refuse, a substance known as meconium, which has accumulated before birth. If this material is not gotten rid of it will poison the pig. Nature, however, has wisely provided for this emergency by putting a high percentage of fat in the first milk that is drawn from the mother. This fat after being introduced into the digestive system of the young pig acts as a laxative and forces the meconium out. Like all young animals, however, the little pig's digestive system is very weak even after the poisonous substance has been removed and great care must be exercised in its feeding. Of all feeds milk probably approaches closer to the ideal food for young pigs than any other. It is about 96 percent digestible and is one of the most digestible foods that we have, and, therefore, the most suitable. Never attempt to give a young pig coarse, rough, fibrous foods such as oat hulls, etc., as they are very objectionable and may work harm. After the youngsters are a couple of weeks old give them a little shelled corn to nibble on and soon after a little milk and other sloppy foods in a trough separate and apart from the mother.

When pigs are from eight to ten weeks old they may be weaned and put to themselves. Weaning may be easily accomplished by keeping the sow off feed during the day before the pigs are to be removed. Permit the pigs to suck her well and then turn her into the pasture. This cutting off of the feed has a tendency to dry the sow up quickly.

It is a very easy matter to overfeed little pigs and it is therefore essential that the previous directions be carefully followed. As mentioned above, after they are two or three weeks old a little shelled corn and plenty of milk will provide for this part of their management. After they are weaned they can be given a definite ration and in the paragraph on feeding a discussion of such rations will be found.

CURING PORK.

The following recipes for the home curing of pork were given to the writer by farmers in different sections of the State, and include only those that have been used successfully for a number of years.

1. *Dry Salt.*—This is one of the simplest methods of curing in vogue today. The meat is thoroughly rubbed with plain, dry, coarse salt and packed in large barrels. It is allowed to remain in the barrels from four to six weeks, depending on the weather. If the temperature is low the maximum amount of time is allowed. When the meat is taken from the barrels the salt is thoroughly brushed off and the hams and shoulders sprinkled with dry borax to keep away skippers. The last process is to hang the meat in the smoke house and smoke well with hickory or other hardwood for several days.

2. *Combination Mixture.*—This process is similar to the dry salt except that several other ingredients are added to the salt. For every thousand pounds of meat the mixture is proportioned as follows:

10 quarts fine salt.
12 ounces salt peter (dissolved in a pint of water.)
8 ounces black pepper.
3 pounds brown sugar.

The ingredients are thoroughly mixed together and result in a damp moist product. This is well rubbed into the flesh side of the meat, which after treatment is placed on a board that has previously been salted. The meat is so placed on the board that no two pieces touch. After curing for three or four weeks the meat is treated with prepared or liquid smoke. It should be painted twice with this preparation, allowing about two days between treatments, and then sprinkled with borax and put in the meat house.

3. *Spiced Ham Cure.*—The following recipe was furnished by a Maryland farmer who has the reputation of producing especially fine hams. The proportions for 100 pounds of meat are as follows:

2 pounds brown sugar.
¼ pound salt peter.
¼ pound black pepper.
⅛ pound red pepper.
2 quarts fine salt.
1 tablespoonful cloves.

Mix the ingredients together and then thoroughly rub all parts of the ham with the mixture. Place hams, skin side down, on boards, exercising care to see that they do not touch each other, and after all are in position the remainder of the mixture is sprinkled on them. In about six weeks they are removed and smoked with hickory wood.

4. *Brine Cure.*—The brine cure has been in use for a great many years and is considered by many to be the most convenient and successful method for farm use. The procedure is as follows:

A good clean hardwood barrel is the one best vessel for brine curing. All the pieces of meat that are to go in the curing vessel should be rubbed with clean salt and placed on a table or shelf for not less than ten hours. This permits the meat to take up the salt before it is packed. The hams and shoulders should be placed in the bottom of the barrel and the lighter pieces on top.

For 100 pounds of meat dissolve 10 pounds salt, 10 pounds brown sugar and two ounces salt peter in four gallons of boiling water. After the solution has cooled it is poured over the meat in the barrel. Weigh the meat down with a clean board and stone so that all pieces are covered with the liquid. Allow the meat to stay in the brine for six or seven weeks and then remove and prepare for smoking.

As soon as it is taken from the brine all pieces should be put in fresh water at a temperature of about 60 degrees and left to soak for about eight hours. This will remove all the salt and thus eliminate the formation of a crust on the outside of the meat when it is being smoked. Smoke sufficiently with hardwood until a light brown or amber color is secured.

BREEDS AND BREEDING.

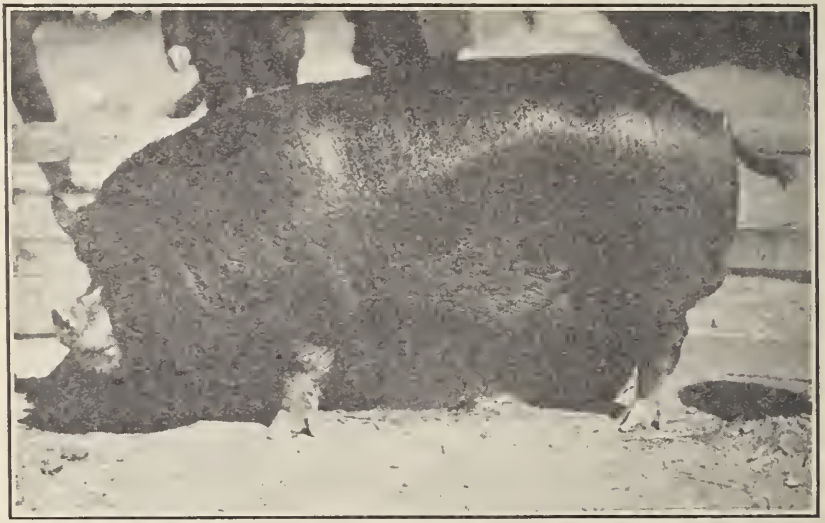
R. H. Ruffner.

Types of Swine.

There are two types of swine, namely the fat or lard type and the bacon type. Both types are found in every locality throughout the State and they are the outcome of local conditions rather than market requirements. The fat or lard type of hog is found where corn is used as the principal feed and the bacon type is found on farms where the hogs receive a variety of feeds.

The lard type of hogs is one which has compact, thick, deep, smooth body and is capable of fattening rapidly and maturing early. The hams, back and shoulders are the most valuable parts and should be developed to the greatest extent. The hind quarters of the fat hog should be comparatively level and the flesh should extend well down to the hocks. The whole body of the animal should be covered with a thick layer of flesh representing the extreme development of meat production. This type of hog, under good conditions, will weigh 200 pounds or more when seven months of age, and this is considered the most popular weight on the market. Because corn is the most available food for our hogs and because the fatter the animals the more pleasing they are to look upon are the reasons we grow more hogs of this type than any other. Until the consumers demand a leaner quality of pork, the lard type will predominate because they mature earlier and in most cases return a greater profit.

In general appearance the hog is low set, the head is short, the back broad and the body deep. Good quality is shown by the fineness of hair and the neatness of the joints. The front legs should be well apart, an indication of chest capacity which shows a good constitution. From the side the legs should appear straight, standing strong on the toes with erect pasterns. The animal should show extreme smoothness throughout the whole body. Wrinkles are undesirable causing much trouble in dressing and giving the dressed hog an unsightly appearance upon reaching the market.



Berkshire Boar.

Berkshire Sow and Litter.

The most popular breeds of the fat type are the Berkshire, Duroc-Jursey, Poland China and Chester White.

The bacon type of hog is different from the lard type in that these hogs are more active, having longer legs and coarser bones and do not carry as much fat as the former. This leanness is particularly noticeable in the jowl and that portion of the leg just above the hock. The strictly bacon type has a much greater distance from shoulder to ham than the lard hog. The shoulders and hams are lighter, but the body of the animal is deep and wide enough to give good constitution. The legs of a good constituted animal are set well apart. The most valuable cuts on the bacon hog are the upper parts of the sides and back. There is an important demand for a leaner class of meat, especially for that which is known as breakfast bacon. The most popular market weight for the bacon hog is from 175 to 200 pounds live weight. After reaching maturity, hogs belonging to bacon breeds have been known to become very fat. The sows of this type have larger litters than those of the fat type, and this is one of the main points argued in their favor by the friends of the bacon hog. It is certainly true, other things being equal, that the sow that is the most prolific is the most profitable.

The strictly fat or lard hog is found in the great "corn belt" of the United States, while the great bacon-producing countries are Denmark, Canada and Ireland. The majority of hogs in Maryland belong to the lard type, yet not to the extreme, for as a general rule Maryland grown hogs receive other feeds than corn and as a result more lean meat is found on the carcass.

Poland China Boar.

The Tamworth and Large Yorkshire are the two breeds belonging to the bacon type. The Hampshire is classified with the bacon type in some sections and especially in Maryland.

BREEDING.

Every farmer who breeds live stock of any kind should feel that it is his duty to improve the animals which he is breeding so that they may nearer approach the end for which man keeps them. If the animals are not mated intelligently the business will not be profitable and disappointment will will be the result. It is hard to tell the practical breeder little that is definite beyond what he himself has already learned from his own experience. If we could only tell the farmer how to produce what he wants and then how to reproduce it after he has once gotten it, our task would be complete. What the breeder has done once he often finds himself unable to do again. One man may be successful and we may follow his methods and fail. The element of chance plays a considerable part. We do believe, however, that if the three following conditions are found in any one man that he will be a successful breeder. First, he must be a student of animal form; second, he must be a good judge; third, he must know what he wants. If you have these qualifications and know that you have them, then breed the "best to the best" regardless of relationship. The men who have made the greatest success in breeding farm animals have possessed these three qualifications, and they did not breed for anything outside of utility. What is the most valuable animal from the standpoint of utility? It is the one that gives the largest pro-

Poland China Sow.

portion of valuable meat; will produce its kind in profitable numbers; and make rapid and economical gains, thus satisfying the demands of both the market and the breeder. A pig would be of little value unless it carried within its make-up, breeding, feeding and killing qualities to a high degree. Animals of the same type possessing the qualities which are most desirable should be bred together.

In-breeding has been used by a few with marked success. They did not in-breed for the simple reason that the animals were closely related, but because the two animals possessed the most dsirable qualities. Mr. Gentry, the great Berkshire breeder, practiced in-breeding because he could not find boars outside of his own herd which he thought suitable for his use. We believe that close breeding should be avoided by the average farmer and practiced only by those who are exceptionally skillful in the art of breeding.

Line-breeding should be used when there is found an exceptional animal and the blood of this particular animal is desirable. In this case the animals bred together trace back to the same individual.

Duroc-Jersey Boar.

Grading.—A grade animal is one whose parent on one side was a pure bred animal and on the other may have been a scrub, or an animal of no particular known ancestry. The sire is usually the pure bred. If pure bred sires of the same breed are used for several egnerations and careful selection has been made, the resulting animals will be known as "high grade." For producing market hogs, a good sow will answer as well as a pure bred provided she is mated with a good pure bred boar.

Cross-breeding means the mating of pure bred animals belonging to different breeds. The crossing of distinct breeds for the production of market stock is not uncommon in this State. Why farmers

Duroc-Jersey Sow.

will continue this method of multiplying swine is hard to understand. No improvement can be made and it is difficult to see how any advantage is to be derived. A thorough study of the practice shows that the cross-bred animal is no better than the pure bred or grade and can never be improved, while the pure bred or grade can be improved year after year. To improve domestic animals that they may be more useful to mankind will be brought about by improving the pure breeds which have already been developed for their special purposes. It is not possible for every farmer to maintain a pure bred herd, but more of our farmers should be breeders and improvers than simply the raisers of commercial stock for the packing houses.

Selection of Breed.

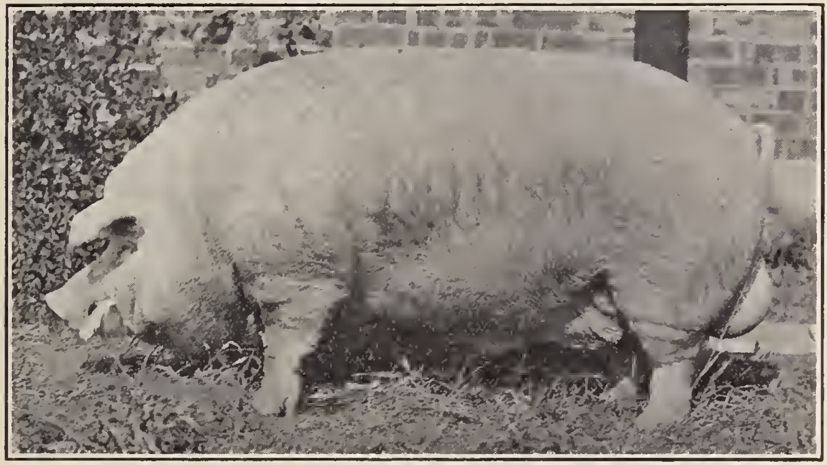
The question of breed is one that should receive no little attention before selection is made. Farmers too frequently start out with one breed and in two or three years become dissatisfied and change to some other breed which they believe will do better. During this time they have made no improvement and yet their hogs may have been profitable so far as dollars go. They cannot look back over several years of work with the pleasure they should feel at the improvement they have made. As a rule a man that will make a success with one breed will be about equally successful with another. The characteristics of the several breeds will be discussed in the following pages, and a study of these descriptions will enable a choice to be made.

Some sonsideration must be given to the purpose for which the hog is to be used. For example, if the hogs are to be sold to a packer who wants as much lard as possible, and lean meat is not recognized, a breed carrying the greatest amount of fat would naturally be the choice. If there is a special market for bacon, one of the bacon breeds should be considered.

There have been several well conducted experiments to determine the breed which would require the least amount of feed for 100 pounds gain live weight. The tests did not prove any one breed to be superior in this respect, nor did they prove that the bacon breeds required more feed for 100 pounds gain. It depends more upon the individuality of the animals used than upon the breed to which they belong. A healthy, thrifty hog, if given a chance will make economical gains, no matter what breed it represents.

THE BERKSHIRE.

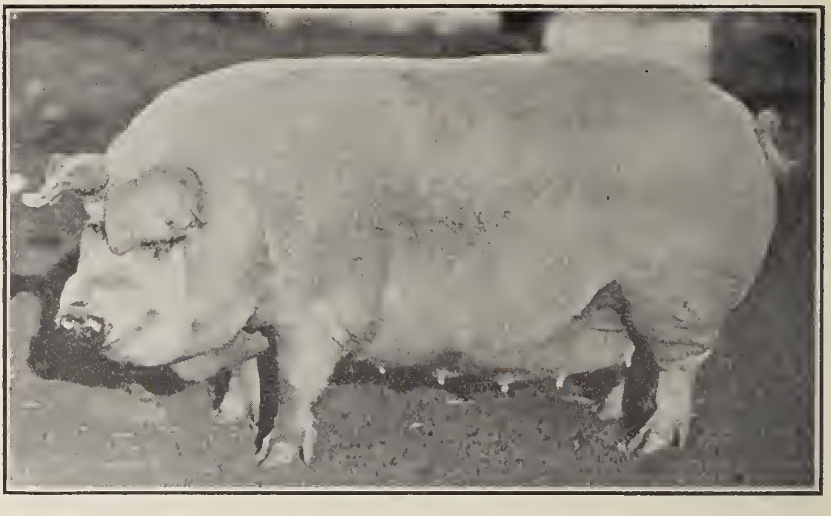
The native home of the Berkshires is England and they derived their name from one of the counties where they were first improved. From the description of early writers the breed was very different from the Berkshire of today. The old type was coarser, had lopped ears, was of most any color, but had the reputation of producing a good quality of meat.



Chester White Boar.

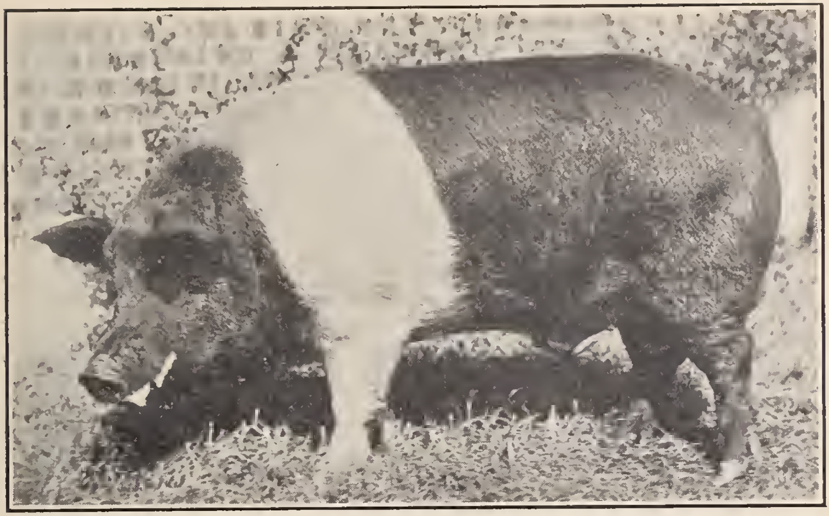
The Berkshire pig was brought to America in the early part of the nineteenth century and has gained in popularity down to the present day. There are more Berkshires in Maryland than any other breed and it is gratifying to know that it is not necessary for anyone to go outside of our State to secure breeding stock good enough for the foundation of any herd.

The Berkshire may be described as being from medium to large. The face is short and slightly dished and the ears are erect, pointing slightly forward but drooping somewhat as the hog ages. The back is noticeably straight, carrying good length. The rump should be rather long and level. The jowl is not as full as that of the Poland China. The shoulders should be thick and even, broad on top and deep through the chest. The hams should be deep and thick extending well up on the back and holding thickness well down to the hocks. The animal is black with white on feet, face, tip of tail and an occasional splash on the arm.



Chester White Sow.

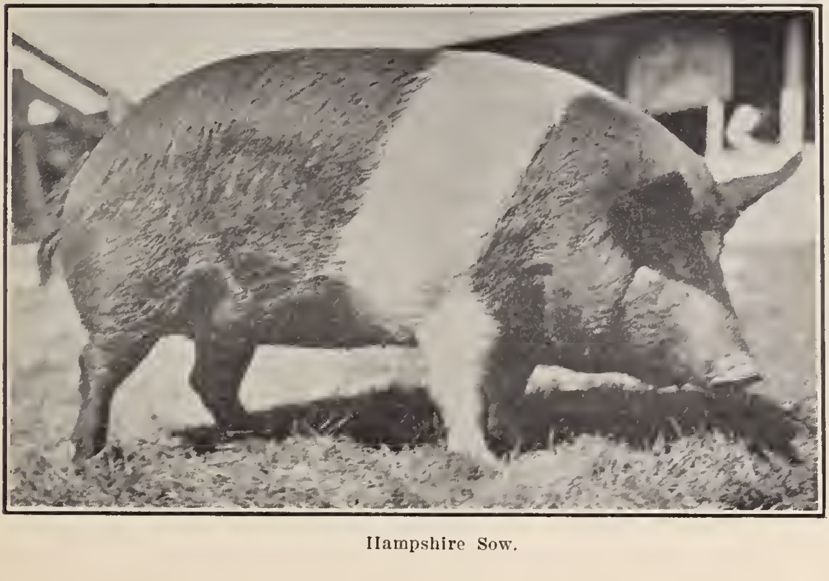
In discussing the Berkshire, Professor Plumb makes the following statement: "The quality of Berkshire pork, viewed from the standpoint of the American market, is of the very best class. Fed in the same manner in comparison with the Poland China, Chester White and Duroc-Jersey, the Berkshire will show a class of meat with a larger percentage of lean than any of them. In feeding experiments conducted by the author at the Indiana Station, in a comparison of Berkshires and Poland Chinas bearing on the influence of food on carcass, the larger percentage of lean to fat in the Berkshire was strikingly shown. The meat of this breed has a fine grain and, when not all corn fed, a desirable blending of fat and lean. In certain localities where select sausages are made, Berkshire pork has been relied upon for securing superior quality. Where properly fed this breed makes a bacon pig of high class, and is so regarded in Great Brtain, though it may not be equal to the Large Yorkshire or Tamworth in this respect."



Hampshire Boar.

THE POLAND CHINA.

The Poland China originated in Butler and Warren Counties in Ohio. The exact origin of the breed is not clearly understood. Systematic improvement began about 1816 and several breeds were used, including the Irish Grazier, which was a large white hog, and the Berkshire. By good feeding and selection improvement continued and in 1872 the National Swine Breeders' Convention, held in Indianapolis, adopted the name Poland China.



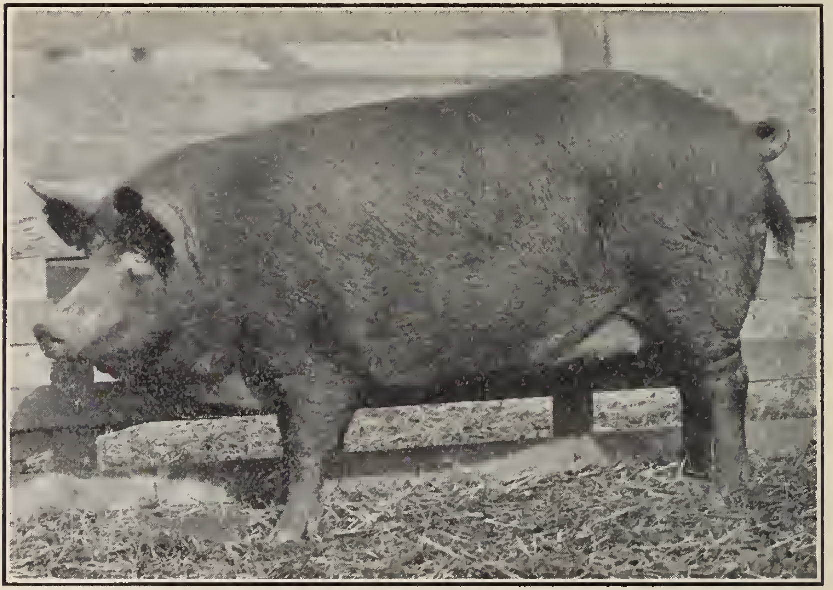
Hampshire Sow.

In color the Poland China is much the same as the Berkshire, being black with six white points. The face is straight, the jowl full and heavy and the ears drooping. The back is very broad, moderately arched, rump sloping, the hams extremely heavy and the legs short. One of the most valuable characteristics of the Poland China is its early maturing qualities. The breed has been criticized because of the large amount of fat, but the packers do not object to this and the price offered is the same as for other breeds.

The Duroc-Jersey.

The Duroc-Jersey is an American breed and had its origin in the eastern part of the United States. Red hogs were bred in New Jersey as early as 1820 and were known as Jersey Reds. Red hogs were also being bred in Saratoga County, New York, and were named after the famous stallion Duroc, while in Vermont the same type of red hogs were known by the name Red Rock. In 1873 Henry Clay imported red hogs from Spain and took them to his estate near Lexington, Kentucky, and Daniel Webster, during the last year of his life, introduced red hogs from Portugal for his farm near Boston. In 1883 the breeders of red hogs from Vermont to Kentucky joined forces and agreed upon a standard of excellence, adopting the name Duroc-Jersey.

With the exception of color the Duroc-Jersey and Poland China are similar. They are excellent grazers and have an advantage over white breeds in that their skins do not blister with the sun, a fact

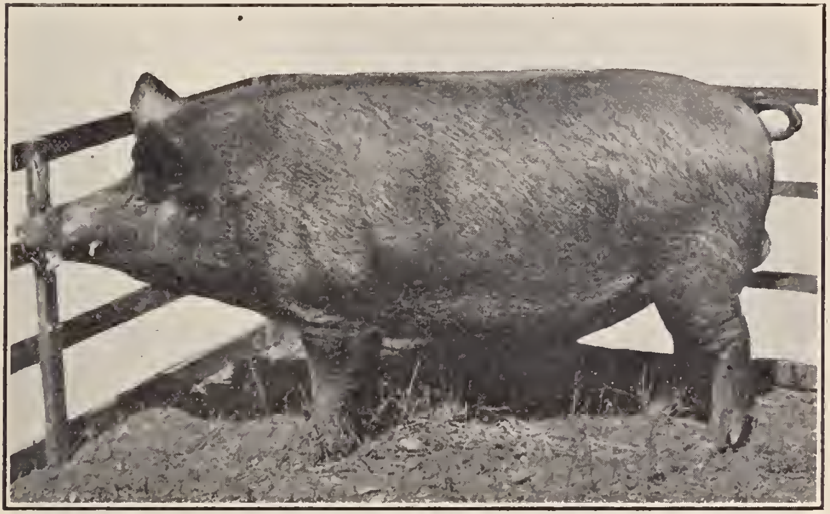


Tamworth Sow.

that is causing them to gain favor in the South. The color should be cherry red without other admixtures. In size they rank with the Berkshire and Poland China. A mature boar weighs about 600 pounds and the mature sow 500 pounds. The Duroc-Jerseys have reached a high rank in the show ring and in the market. They are ngaiing an increasing share of popularity in new regions, mainly on account of their pork-making virtues and because many men with means are taking a keen personal interest in the breed.

THE CHESTER WHITE.

The Chester White is one of the oldest American breeds, originating in Chester County, Pennsylvania, about the year 1818. White hogs were taken from Connecticut to Ohio in 1830 and later hogs were introduced from Pennsylvania into Ohio and bred with the hogs that had come from Connecticut. In 1865 L. B. Silver of Salem, Ohio, visited different places where Chester Whites were being bred and selected what he considered to be the best individuals. His idea was to eliminate all the weak points and establish a new breed. His strain was later known as the Ohio Improved Chesters (O. I. C.). Whatever he accomplished did not surpass the development made by some of the other and older breeders of the Chester Whites. There were others who claimed that their strains were different and there developed, unfortunately several names and at present we have the following different herd books and associations:—Chester White Swine Record Association, Rochester, Indiana; National Chester White Record, West Chester, Pennsylvania; O. I. C. Swine Breeders' Asso-



Tamworth Boar.

ciation, Goshen, Indiana, and the National O. I. C. Chester White Record Association, Kansas City, Kansas. There is also a Government Swine Breeders' Association at Toronto, Canada, that records Chesters. The International Livestock Exposition held annually at Chicago recognizes but one breed, namely the Chester White, although they may be registered in any of the above herd books. It is hoped for the sake of economy and the breed that these different associations which in reality represent but one breed of hogs, all of the same type, will unite and adopt a standard of perfection and agree upon one name.

In conformation the Chester White is similar to the Poland China or Duroc-Jersey. The Chester White is noted for its early maturity. The sows are especially prolific, no other breed of the lard type surpassing them in this respect. They are extremely popular in the New England States, New York, Pennsylvania, and in sections of the "corn belt."

The Hampshire.

Probably no breed of swine has improved so much and grown into popularity so rapidly within the past ten years as the Hampshires. Originally this breed was known by the name Thin Rind, but in 1904 the name was changed to Hampshire. It is claimed that the foundation stock of this breed was brought from Hampshire, England, but the origin is not definitely known.

The Hampshire is black with the exception of a white belt encircling the body taking in the fore legs. They are medium in size and in type may be classed somewhere between the bacon and fat hogs. The body is of medium length and the legs are longer than any of the lard breeds. The snout is relatively long and straight. The ears are medium length, slightly inclined outward and forward. The jowl is light and the shoulders and hams are of medium fullness. The quality of flesh is considered good, carrying a high per cent of lean, and is fine grained.

The Hampshires are numerous in Kentucky, Indiana, Oiho and Illinois. A few registered herds are maintained in Virginia and Maryland.

The Tamworth.

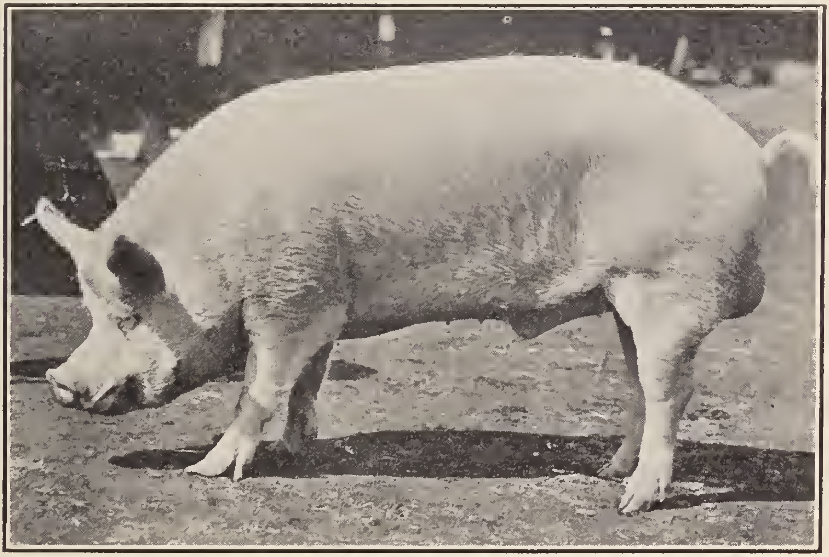
The Tamworth is one of the oldest, if not the oldest, breed of swine in existence. They were first introduced into England from Ireland in 1812 by Robert Peel, who while living in Ireland as a British official, was favorably impressed by the lean delicious meat of the Irish breed, and knowing the great fecundity of the sows, took some of them back to his estate at Tamworth, where his descendants have since bred and improved them. The Tamworths were first imported to the United States in 1882, but have not made rapid progress. Possibly the uncouth form of the Tamworth head tends to prejudice the farmer against them.

One would never mistake a Tamworth for any other breed. They are a golden red and have a flesh colored skin free from black. The snout is longer than that of any other breed and the ears are carried rigid and inclined slightly forward. The sides are long and deep, but the hams lack the development found in the lard breeds. For quality of bacon it is rivaled only by the Large Yorkshire. The large proportion of lean to fat and the great length of side, render the breed particularly desirable from the bacon-curer's and the consumer's standpoint. The local trade likes them because the carcass can be cut on the block and sold to the retail trade without trimming. The sows make good mothers and are wonderfully prolific, generally bringing from ten to fifteen pigs at a litter. There are many people who believe the Tamworth is not an economical producer, as they claim it requires more feed per pound gain, but this claim has never been substantiated.

THE LARGE YORKSHIRE.

The Large Yorkshire breed of hogs was brought from England to the United States about 1840. This is one of the largest breeds of swine. They are of the bacon type, are upstanding, comparatively narrow, long and deep with light shoulders and hams. The head is of medium length and the face is dished. They are white with pink skins.

The Large Yorkshire is highly valued for its bacon. The large production of lean to fat and their rapid growth make them very popular, especially where hogs are fed for bacon export trade. The Large Yorkshire sows are prolific and make good mothers, producing an abundance of milk.



Yorkshire Boar.

The Mule-Foot Hog.

The Mule-Foot hog is so called from the fact that it has a single hoof like that of a mule. The foot is solid, short and smooth, enabling the animal to carry its own weight with ease. The color is black, but white points are admissable. Its origin is unknown. It is neither a lard nor a bacon hog, but a medium between the two. It is claimed by admirers of the breed that they are immune from hog cholera. Such an assertion is erroneous. Mule-Foot hogs are liable to have any disease to which the porcine race is subject.

DISEASES OF SWINE.

Dr. S. S. Buckley.

The raising of swine where breeds, feeds and equipment are suitable, and where directed by a husbandman proficient in feeding and management, may not be profitable because of disease or because of improper regard for the vigor and stamina of the animals.

Statistics are not available as to the probable losses of swine in Maryland through disease, but there is no questioning the fact that a a greater percentage of deaths occur of the total number of hogs born than occur in any other class of animals.

The individual loss per animal through death may range from one dollar upward, according to age, size and breed. Similarly the losses through diseases which are not fatal may range from a few cents to several dollars per animal through loss of weight, through stunting the normal growth of young animals, and through abortion or sterility of sows. The aggregate annual losses through diseases of swine in Maryland is enormous.

Classification of Diseases.

In an extensive consideration of diseases of swine it would be desirable to classify them in well defined groups, but limited space makes it necessary to restrict the subject to those diseases known to be common in Maryland without special classification. Before taking up individual diseases it is well to refer to the terms sporadic, contagious and infectious. Sporadic diseases are scattered or isolated affections of animals occurring without a constant or specific cause. The same conditions operating as a cause of disease in one animal may not produce disease in other similar animals equally exposed, and may not at another time produce disease in the same animal under like circumstances. Examples of this type are congestions and inflammations, colics, fevers, digestive disturbances, etc. Such diseases are not transmissable from animal to animal.

Infectious diseases are affections of susceptible animals, occurring as a result of exposure to specific animal or vegetable parasites. These parasitic bodies must necessarily be able to live and reproduce within the body, though many are capable of living and reproducing outside of the animal body These parasites may enter the body by various routes, e. g., with air, food, water, by the skin, etc.; and may be derived from water, soil, plants, etc,, or may come directly or indirectly from other animals. These latter are known as infectious diseases of the contagious type or contagious infections.

Contagious diseases are infectious diseases, in which the specific animal or vegetable parasites are unable to live and reproduce outside of the animal body, but require to be transmitted from one individual to another by mediate or by immediate contact. The carrier or vehicle of transmission of vegetable parasites is known as the contagium or virus. The various diseases which follow will be designated as sporadic, infectious or contagious, in order that proper herd measures may be put into operation immediately upon the character of the disease becomes recognized.

Sore Mouth of Pigs.

Sore mouth may be present in swine of any age as a *sporadic* disease and be caused by hot, decomposed or irritating foods or as a result of direct injuries to the mucous lining of the mouth by broken or decayed teeth. These cases are recognized by saliva drooling from the mouth, loss of appetite, and red, feverish patches on the mucous lining of the mouth cavity. The trouble is corrected by removing the cause of irritation and treating the affected parts with a 2 percent solution of boric acid, a 2 percent solution of chlorate of potash or a 1 percent solution of alum.

The food supplied should be freshly prepared and sloppy in nature. Milk may be advantageously used in these cases, mixed with bran or middlings. Cool fresh water should be supplied frequently.

Sore mouth may also affect suckling and young pigs, which is *infectious,* and possibly somewhat contagious in nature.

In this affection the gums are usually first affected, followed later by swollen and inflamed lips and membranes lining the mouth. There may be associated with it difficulty in breathing. The pigs are seen not to nurse well and may be unable to suckle at all. They become feverish, weak and thin, and there follows gray colored elevated small spots or ridges on the lips. These enlarge and finally break, leaving pit-like ulcers or cracks.

The mouth presents a foul, disagreeable odor of decay and the discharge of saliva is dark and may be tinged with blood. There is likely to be diarrhoea or scouring.

Unless treated early they die from exhaustion. Those less seriously affected are stunted and perhaps deformed and rarely are profitable to raise.

Cause.—Infectious sore mouth of pigs has been ascribed to the *bacillus necrophorus.* This organism has been found in the excrement of normal hogs and appears to be readily destroyed by the common disinfectants. It gains entrance into the tissues either through the broken skin, or in the case of young pigs probably as a result of the rubbing of the gums on the soiled teats of the sow in the act of nursing.

Prevention and Treatment.—Prevention lies in keeping sows with young pigs in clean, dry quarters. When the infection is known to exist on a premises recourse must be had to the use of mild disinfectants in the pens. Clean pens thoroughly and sprinkle lightly with air-slacked lime or gypsum, or spray the floors with a 2 percent coal tar disinfectant.

The sow's udder and teats should be washed daily with a 1 percent coal tar disinfectant and the heads of the diseased pigs should be dipped with the mouth open in a 2 percent solution of chlorate of potash as deeply as necessary to cover the diseased parts. The ulcers should be treated by touching with equal parts of tincture of aconite and tincture of iodine.

Badly diseased pigs showing deep ulcerations had better be destroyed and their carcasses buried deeply with caustic lime or be burned.

RICKETS, RACHITIS OR SNUFFLES.

This must be considered as a *sporadic* disease, although there is reason to believe that infection may yet be proven to be a factor in its cause. It is a disease of young animals, and is due to a faulty transformation of food nutrients into body cells and tissues. It manifests this fault in the manner in which the deposits of mineral matters occur in the development of bone, on account of which bones and cartilages of the skeleton assume such shapes that deformities result. These deformities are more pronounced in the bones which are prone to mechanical irritation, as the legs and jaws.

Young pigs become affected usually shortly after being weaned, and those breeds or strains maturing at an early age are more liable to the affection than those maturing at a greater age.

Cause.—A deficiency of lime salts in the food is directly responsible for insufficiency of these elements in the bony skeleton. This condition is more likely to occur after weaning and before the pigs become old enough to seek the required mineral matters from the earth, through eating roots, etc., containing soil.

Another factor which must be considered is the inability to appropriate the lime salts, actually in abundance in the food, because of a deranged digestive system due to constipation and the absorption of consequent poisons, to scouring, to intestinal parasites, etc. Contributing causes undoubtedly are close confinement, lack of exercise, and dark, unhygienic quarters.

Mere fatness of pigs is not in itself an indication of condition, as fat pigs seem to suffer frequently and more severely than those less fat, when ill.

Where this disease is more or less always present it is an indication of lowered vitality or of faulty methods of feeding and management and not of infection of the premises.

Symptoms.—Pigs are usually fat and in apparently good condition at the beginning of the disease when they suddenly lose their desire to eat, appear somewhat bloated and begin to scour. Paralysis of the hind parts or painful use of them comes on suddenly, and later deformity of the bones of the leg or fractures of these occurs. In other cases the bones of the lower jaw become deformed and those of the face as well, accompanied by sniffling and difficult respirations. This condition is known as *Snuffles* and is sometimes regarded as a distinct affection.

The progress of the disease may be rapid and end in death or may become chronic and last for weeks. In the chronic cases the pigs become stunted, but may recover. These, however, are unprofitable to raise.

Prevention and Treatment.—This disease must be prevented by supplying suitable food, dry, warm, clean, light and well ventilated quarters and opportunity for exercise. The use of bone-meal or chalk in the ration is excellent treatment. A box containing rock salt and charcoal or soft (bituminous) coal should be supplied. A teaspoonful of pulverized chalk daily for each pig mixed in the feed will give excellent results. Seriously affected cases with much deformity should be destroyed as a matter of economy. Intestinal parasites, if present, should be removed by proper remedies (see Page 65) and the digestive functions made normal.

DIARRHOEA—SCOURS.

While this affection in young pigs, or in swine of any age, is commonly regarded as a primary disease, it is merely a symptom which is common to a large number of affections. For the purpose of this report, however, it will be considered independently.

Cause.—Faulty diet of sows may produce scours in suckling pigs. Scours also frequently occurs in suckling pigs when only a few days old as a result of feeding sows too soon and too heavily after farrowing. This practice causes a congestion of the udder and besides resulting in too great a flow of milk, the quality of the milk is probably also altered.

Improper feed or overfeeding will cause digestive disturbances in weaned pigs and older swine, with diarrhoea as a symptom. Cold, damp, dark and generally unhygienic quarters, with little opportunity for exercise is frequently responsible for this affection. In other cases the trouble becomes general in the herd and the cause must be looked upon as infectious.

Symptoms.—Depending upon the cause the symptoms may vary. When due to early feeding of the sow, scouring appears in the majority of the young pigs during the first day or two, and is recognized by fluid evacuations, which have a very offensive odor. These cases are very fatal.

When the trouble occurs at a later age the symptoms of diarrhoea may be preceded by constipation, and may be confined to certain individuals, and not be general in the litter. The appetite may remain good for a short time after scouring begins, but it is gradually lost and the pigs become weak and dull and they appear to suffer from abdominal pains. In more mature swine the symptoms of diarrhoea are dependent upon the cause and vary in nature and intensity.

Prevention and Treatment.—Preventive measures must be directed against errors in feeding and management of sows and the herd generally. Proper quarters and runs which are kept in hygienic condition is imperative. It must be recognized that hygienic surroundings can be maintained without great difficulty even for swine.

Medicinal treatment is difficult to apply A few drops of laudanum placed on the tongues of young pigs may prove beneficial. Older individuals may be given laudanum and castor oil as treatment for the symptoms shown, but the primary affection or cause must be removed.

The following is recommended for trial for suckling pigs because of its success in the treatment of scours in calves with formalin. Wash the sow's udder once or twice daily, wipe dry and wet the teats and the area about them with a mixture of one fluid ounce of formalin and 15 fluid ounces of water. This will enable the suckling pigs to receive very small quantities of formalin, which may prove beneficial. In older pigs one drop of this mixture may be added to the feed for each pound body weight.

THUMPS—SPASM OF THE NERVES OF THE DIAPHRAGM.

This affection is *sporadic*, though several cases may be observed simultaneously in a litter.

Cause.—It is a reflex upon the diaphragmatic and cardiac nerves as a result of irritation of the nerves along the digestive tract, or in some cases as a result of excessive exercise and excitement.

Symptoms.—Thumps manifests itself by a peculiar, audible jerking movement of the sides of the body and consequently bulging of the flanks. These symptoms are more apt to be seen when the stomach is full or after quick exercise. The affected animals lose flesh, become more or less stunted and have poor appetites.

Prevention and Treatment.—Proper feeding and management and exercise will usually effect a cure. Turning out the sow on pasture will cause young pigs to take exercise. Medicinal treatment ir rarely ever indicated.

GARGET, MAMMITIS-MASTITIS.

Inflammation of the udder frequently occurs in sows if they are fed at all within 24 hours or heavily fed within the first week or ten days after farrowing, or where part of the litter has died. Local injuries or infection may cause the disease as well.

Symptoms.—The udder becomes feverish and congested. The character of the secretion changes until serum only can be withdrawn. This is not satisfying to the pigs and they refuse to suckle. The udder then becomes hard and the function of milk secretion may be permanently lost to the affected parts.

Prevention and Treatment.—Withhold all feed from farrowing sows for the first twenty-four hours and gradually bring on to full feeding at about one week or ten days. Where several of a litter die, reduce the feed of the sow and give dry feed. Bathe the congested udder with hot water and gently massage. Apply belladonna ointment.

ECZEMA—SCAB-MANGE.

This affection rarely occurs independently of other diseases, and is usually found affecting young pigs which are not properly cared for. It has been noticed frequently in herds where hog cholera exists and often accompanies rickets. While not particularly dangerous it is very distressing to the pigs at the stage where the intense itching symptoms are shown.

Cause.—Besides the low condition of the animals resulting from the primary disease, filthy, dark and damp quarters are contributing causes in this affection. Extreme heat also favors the appearance of this trouble. The actual cause, however, must be regarded as arising from the effects of the secretions and excretions of the skin glands.

Symptoms.—The skin may appear red, hot, swollen and sensitive. There is a rapid development of reddened elevated points, which finally assume the nature of blisters and pustules. Small areas of skin become moist and slough off. These pustules and sloughed off areas become covered with dry scabs or crusts. The presence of blisters and pustules distinguishes this affection from ordinary irritations due to lice, dipping solutions, etc.

Prevention and Treatment.—Lice, filthy quarters and all conditions acting as irritants to the skin should be overcome.

Dipping affected pigs in 1 percent coal tar disinfectants has been recommended. Picric acid solutions although at first irritating, will probably give better results. Bicarbonate of soda and Fuller's earth used as a dusting powder will allay the intense itching.

Medicinal treatment is hard to apply and preventive and corrective measures are most strongly advised.

LICE.

The common hog louse is widely prevalent and usually easily controlled. It is spread from hog to hog by contact, in pens, crates, cars, etc. Dirty quarters favor the propagation of this pest. It is a serious affection, particularly in young pigs, and is responsible for loss of appetite and poor condition. The irritation produced by the lice and by rubbing in the effort to dislodge them, causes sensitiveness of the skin and the development of skin rash.

Prevention and Treatment.—Keep the quarters clean and free from litter. Spray the hogs or dip them, using kerosene emulsion or coal tar disinfectants. Remedies applied in the evening are more effectual and productive of less injury to the skin. Naphthalene flakes or moth balls about the sleeping quarters will prove beneficial. All successful treatment for lice is dependent upon clean quarters and regular application of remedies at intervals of about one week until the pest is controlled, since most remedies which kill the lice do not destroy the nits.

INTESTINAL WORMS.

There are several species of worms which infest swine and these may for practical purposes be considered together. The effects of intestinal parasites upon the swine industry is of much greater importance than is generally believed. The conditions favoring the presence of parasites in swine in themselves are serious, indicating as they do, carelessness in the management of the herd and its surroundings. Somewhere the advice was given "if pigs are not thrifty and the cause cannot be determined treat for worms." This is sound advice and worth following.

Symptoms.—The symptoms exhibited by swine infested with intestinal worms are not always proportionate to the number of worms present. The younger the pigs usually the more serious are the results. There is a variable appetite and loss of weight. The pigs vomit and may suffer with alternate constipation and diarrhoea. The presence of worms in the excrement is the best evidence of infestation.

Prevention and Treatment.—Frequent cleaning of the pens and yards destroys large numbers of eggs which are expelled from infested pigs. Yards and runs should be plowed several times during a season or double yards provided so that they may be used alternately. Provide clean feeding and watering troughs.

Medicinal treatment is best given by dividing up the herd into pens containing five or six animals each and mixing the vermifuge in the feed according to the weights of the pigs.

Five grains of calomel and five grains of santonin for each hundred pounds weight of pigs gives excellent results. Turpentine or gasoline is useful and may be given in milk.

TUBERCULOSIS.

Tuberculosis has become well established as a disease of swine and appears to be increasing in extent in those sections where dairying is practiced. This disease may become transmitted by the practice of following cattle with hogs where the cattle are corn fed and by feeding pigs with surplus milk from the dairy herd or skimmed milk from creameries. It is evident, of course, that in both cases the cattle must be more or less infected themselves to cause the disease in swine. Pigs from sows with badly tubercular udders rarely survive, so that this source of infection is not as great as generally supposed. When these do survive, or contract the disease at a later age, there are no characteristic symptoms shown. The infection is principally recognized at slaughter and may be looked for in large fat hogs as well as in those in poorer condition. This is due to the fact that ordinarily tuberculosis is a slowly developing disease, while on the other hand swine are rapidly maturing animals.

Symptoms.—In pigs which have acquired the disease directly from sows, the symptoms appear early and are manifested by diarrhoea, loss of flesh and disorders of respiration. Paroxysms of coughing occur, and after the dislodgement of phlegm the respirations become rather normal again until further accumulations give rise to another paroxysm. When affected thus early death nearly always occurs. When the infection occurs later the pigs may survive and fatten without showing symptoms of infection.

Prevention and Treatment.—In this disease it is necessary to avoid all opportunities for infection. When the disease is known to be present in a herd it should be eliminated by the most economical methods and expert advice should be called in. No form of treatment will effect a cure and should not be attempted.

Hog Cholera.

This disease is the greatest menace to profitable hog raising in Maryland. It is rarely found to exist as an independent disease, but is associated with other diseases produced by organisms and causing a mixed infection. The losses have been estimated to be about three hundred thousand dollars in Maryland annually.

Cause.—This disease is due to a form of infection known as a filterable virus. This filterable virus is capable of being distributed easily from one premises to another and for great distances. The exact means of transmission is unknown. It is highly infectious and swine are peculiarly susceptible. No other species of animal is susceptible to this infection.

Symptoms.—The animals appear dull and are inclined to lie quietly in the bedding. Several affected animals will lie huddled together. The eyes are at first dull and droopy. Later they become watery and the discharges dry up, leaving the lids more or less gummy and glued together. As the disease progresses they become weak and stagger in walking. The back is arched and the abdomen tucked up. The respirations are short and rapid. The appetite is poor; and thirst, due to fever, is increased. Temperatures vary from 103 to 108 F. The animals may cough and vomit frequently. Loss of flesh is well marke.d Red or purple spots or areas, to be seen back of the ears and along the belly, are due to skin hemorrhages. There may be constipation or diarrhoea. The discharges may be thin and show the presence of blood. Evacuations are painful. In some individuals and in some herds the symptoms may be well marked and characteristic, while in others they are scarcely noticeable.

In the dead hog we may recognize the disease by loss of flesh, hemorrhages of the internal organs, congestion of the ''kernels'' or lymphatic glands and marbling or mottling of the lungs. The kidneys show ''turkey-egg'' spots which are characteristic. The inner surfaces of the large intestine show the ''buttons'' or ulcers, especially at the orifices of the caecum or ''blind gut.''

Prevention and Treatment.—Keep hogs and pens in the best possible condition. Avoid placing newly purchased hogs in the pens with others for at least thirty days. Do not allow hogs to graze where they will be exposed to other hogs or to graze at all near railroads over which hogs are shipped. Report any cases of sickness among hogs in your neighborhood, giving as complete a description as possible of the symptoms to the Experiment Station, College Park, Maryland.

Write for Bulletin No. 174 from this Station and, read it.

Have your swine treated with protective serum, or at least acquaint yourself with the method of protecting hogs against this disease and avail yourself of it as soon as your swine are exposed.

Do not regard the serum treatment as such a perfect specific in the immunization of hogs against cholera that all other measures of protection, care and management can be disregarded. The hog owner who wishes to be successful must familiarize himself with hog cholera.

He should study the subject of simultaneous treatment and have veterinary advice and services in its use. With this treatment successfully given the disease will have no terror for the owner, and when applied to young pigs is a matter of slight expense.

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LAND DRAINAGE IN MARYLAND

By JOHN R. HASWELL, Drainage Engineer,
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INTRODUCTION.

The agricultural development of the State of Maryland has reached a point where better drainage is demanded in almost every section. The coastal plain section contains but 2,650 square miles of land surface, in which occurs much the greater part of the 517 square miles of swamp and marsh land in the State. In other words, the area of wet land is almost one-fifth of that section; the need for action is apparent. Owing to the uncertainty of the resulting crop the up-to-date farmer is beginning to realize that he can not afford to plant good seed, apply costly fertilizer, and expend constant labor on low land that is not well drained. Owners of the large tracts of swamp lands, dissatisfied with paying taxes on their holdings in their present condition, are looking for satisfactory means of reclaiming the marsh areas, thus making them suitable for settlement. Also the State road system is making accessible large tracts that have not heretofore had easy communication with the markets for produce.

Notwithstanding this desire for improvemnt, rough open ditches are in some sections still used for field drains, tile for underdrains being considered an extravagance. In quite a few cases, it is true, the use of tile may well be said to have been an extravagance, since no levels were taken before the trenches were dug, the tile-laying was done by unskilled laborers, and no attempts were made to maintain the systems after they were once installed. In some places, indeed, tile have been placed in the soil apparently with little expectation that they would permanently remain open. Tax ditches are still dug without a survey, they are made too small and landowners continue to be unfairly assessed for the costs. The purpose of this bulletin is to show briefly what properly-constructed drainage improvements have accomplished and will accomplish in developing farm lands in the State, and to offer suggestions that may assist in the proper application of drainage in all parts of Maryland. The bulletin is based upon the work performed in Maryland by Drainage Investigations of the Office of Experiment Stations, United States Department of Agriculture, and has been prepared at the suggestion of the Director of the Maryland Agricultural Experiment Station.

Benefits of Drainage.

Drains are installed to increase crop production and to enhance the value of the land. There are a number of reasons why drainage increases the crop production, most of them depending on the mere fact that the water is removed from the soil. The action of the drains, however, is to remove only the *surplus* water; this is called gravitational water because it will run into the drain by the action of gravity. The water needed by the crops is held in the soil by capillary attraction and cannot run off, the action being the same as that by which paint is held in a brush or oil is drawn up and held by a lamp wick. As the plant uses the capillary water more is drawn from the subsoil by this same action. If water is running in the drain this attraction will draw some of it out.

The various effects of drainage will be briefly discussed in order.

1. *Increases supply of available plant food.* As the pores of the soil are freed from water, air takes the place of the latter. The air acts on the minerals of the soil, aiding in reducing them to compounds suitable for plant food. Many soils that require draining have a mottled appearance below the top soil. After sufficient aeration this characteristic tends to disappear and the color of the soil becomes uniform, indicating the chemical action referred to above.

2. *Helps the growth of desirable organisms.* Draining the soil aids in promoting the growth of desirable organisms. Drainage is of the utmost importance when inoculating for alfalfa and other nitrogen gathering crops, since the bacteria in the inoculating material thrive better in a well-drained soil.

3. *Improves granulation.* The alternative wetting and drying of a well-drained soil will cause the minute particles to draw together into small crumbs. This formation is opposed to the solid surface presented when an over-wet piece of land finally dries out. The latter plows up in clods and is difficult to till. On the other hand, the well-drained land is easily cultivated.

4. *Conserves moisture in dry years.* The opening of the soil increases the number of pores and thus gives greater capacity for capillary moisture. A well-drained field will therefore better withstand a drought than will similar land with poorer drainage. It must be understood, however, that the retained moisture is of the capillary kind and is not "dead" water.

5. *Raises soil temperature.* The words "cold" and "damp" are used in speaking of an over-wet soil, because the evaporation from a wet soil cools the surface. Actual thermometer records have shown drained soil to be from 7 degrees to 15 degrees warmer than similar

soil in adjacent fields which was too moist. It requires much more heat to raise the temperature of water one degree than for soil, so that in the case of a soil filled with water the growing season will usually commence from one to two weeks later in the spring; the ground will also freeze earlier in the fall. The farmer who is raising an early truck crop cannot afford a delay of two weeks occasioned by wet land.

6. *Enlarges root zone.* Some farmers believe their land to be well drained so long as water does not show on the surface, and they cannot understand why their crops suddenly cease to thrive after getting a good start. The free water in the soil is usually some distance below the ground surface and lies in a more or less level sheet, the elevation of which can be seen by looking into a pit dug in the field. The upper surface of the water is called the "water table." A water table near the surface of the soil is frequently the cause of the crop condition just referred to, for the roots go down until the water is reached, when the growth stops abruptly. It is true that some thin water roots may go further down; but these do not aid the plant in producing a crop, and when the land dries these roots die. Drainage thus enlarges the root zone in the soil by lowering a high water table. It has been said in reference to general crops, "If water appears in a post hole three feet deep, your land needs drain tile." This is a good test and should be applied by those wishing to get the best results from their land.

7. *Reduces loss from freezing.* Winter crops in soil that is too wet are frequently thrown out by "heaving." In other words, the moisture near the surface of the soil freezes in a sheet and the upper crust rises, pulling the main stalk of the plant with it, while a number of the smaller roots which are deeper in the ground are broken off in the soil. "Heaving" is sometimes the cause of heavy loss.

8. *Removes injurious salts.* A number of farmers along the Chesapeake Bay and it tributaries are greatly inconvenienced by the washing of salt water over their land, due to very high tides that occur perhaps once in five or six years. The sea water evaporates and the salt is deposited on the surface of the ground, killing any crop which may be started. If the water runs off the land without evaporation no damage is done; but in some places the salt water cannot run back into the bays when the tide goes down, and it stands in pools. If the land is tiled the water will pass into the soil with the salt still in solution. The capillary water will be retained by the soil and will be salt until the next rain occurs, when the rain water will sink into the soil and force the salt water into the tile. Thus there will be little evaporation of salt water on the surface and any salt which may have been deposited will later be dissolved by rain water and carried into the tile.

9. *Reduces erosion.* Scattered over the western shore and southern Maryland are a number of hilly farms on which the top soil is being washed away and the fields deeply gullied. Erosion is often one of the most destructive agents that the farmer has to combat.

By its action the deep seed bed is ruined and the humus and plant food which have required so much time, labor and money to place in the soil are carried away. By properly protecting the hillsides by means of terraces, ditches, or tile, the water may be removed from the surface of the ground and taken off in channels that will not wash. Tile is fast coming to the front in this work because terraces and hillside ditches occupy much valuable land and break up the field to a more or less extent.

10. *Firms the soil.* The removal of the saturating water in the soil makes the land firm and much easier to drive over. This is of great benefit in all agricultural operations, for frequently it is almost impossible to harvest a crop of corn because sections of the field will not support the weight of a loaded wagon. It is also much easier to plow a soil that has only the proper amount of capillary water in it than is the case with one completely filled with water. When a saturated soil is plowed the particles run together and "puddle," which is one of the worst things that can happen to a soil, particularly one that has a fine texture, and it requires several years of careful cultivation to bring the soil back to a good condition.

11. *Improved health conditions.* Malaria is spread by mosquitoes which breed rapidly in stagnant water. The benefits derived from draining ponds often include a considerable saving in doctors' bills. Stock pastured on well-drained soil make a better growth than is the case on undrained land, and they are less frequently sick.

To sum up the effects of drainage, it will convert a cold, damp, heavy soil into a warm, mellow and easily tilled one, and it will make the soil more retentive of fertilizer and necessary moisture, therefore putting the soil into the necessary physical condition for producing the best crops. It has frequently been demonstrated that the increased yields of farm crops will pay for the cost of drainage in from one to three years. Below some statements are given of results attained in Maryland. Prof. W. T. L. Taliferro has analyzed corn grown at the Maryland Agricultural College both on well-drained and on poorly drained land. The corn grown on the former contained a greater percentage of protein, making it more valuable for food. Thus drainage not only increases the yield but also the quality of the crop. Moreover, the health of the farmers' family and that of his stock is safeguarded by the better sanitary conditions that result from drainage.

Results Obtained in Maryland.

There are numerous examples of successful drainage systems in the State; however, only a few from different localities will be mentioned to demonstrate that the above-stated benefits can be had in Maryland.

Under date of October 28, 1911, Francis M. Wilson, Pocomoke City, Worcester County, wrote: "This draining of land is a great thing. I have put some 4-inch tile in some wet cuts of land where the crops formerly drowned out if any heavy rains fell. Since putting in this tile last fall I have grown a crop of oats; this spring, after oats, I sowed in peas. I have harvested the peas and put the same land in wheat. After wheat comes off in June I shall sow in peas again or scarlet clover. Prior to putting in the tile I never grew one crop a year with any success.'' In February, 1914, Mr. Wilson expressed himself as fully satisfied with the results of drainage and stated that he could grow almost any crop on the reclaimed land.

J. Fletcher Clark cleared 30 acres of woodland on his farm north of Easton, Talbot County, and discovered that there were a number of depressions between the farm house and the State road. These depressions held water the greater part of the year, detracted from the value of the property, and were a constant breeding place for mosquitoes. In 1911 Mr. Clark applied to Drainage Investigations, United States Department of Agriculture, for assistance in reclaiming the waste land. Figure 1 shows a small pond just before the outlet ditch was dug; Figure 2 shows the same pond two years later, after the installation of one line of 4-inch tile. The two photographs were taken from the same position. The mere removal of the ponds is stated to have increased the value of the farm by an amount sufficient to pay for the tile and labor, exclusive of the value of the crops that have been produced on the land formerly occupied by the ponds.

While it is true that the eastern part of the State has a greater area of land in need of draining, it is also true that Western Maryland, from a drainage standpoint, has more at stake. Due to mountains and rocks there is far less tillable land per square mile in Western Maryland than in the eastern part of the State, and, therefore, every acre in the west made suitable for cultivation means an addition of much more to the total percentage of cultivable land than is the case in the eastern portion.

In order to determine the profits that have accrued from draining, a set of questions were put to a group of farmers living in the southern part of Garrett Couney. The following facts are taken from their replies: The work was started six years ago on plots varying in size from 25 to 70 acres. The soil is a heavy clay washed in from the hills, requiring that lines be closely spaced; these conditions made the work cost from $25 to $53 per acre for the ditching and tile. The favorite distance apart for laterals was 50 feet, and the depth from 2½ to 3½ feet. The usual rotation was buckwheat, oats and grass; while in some cases potatoes, wheat and corn have been grown. The crop yields showed a general increase during the first few years after the drains were installed; and as most of the land would produce nothing but swamp grass before it was drained, the crops have been almost clear profit. The reported yields per acre were: Buckwheat, 20 to 41 bushels; oats, 50 bushels; hay, 2 to 2½ tons. Before draining one ton of marsh grass per acre could be cut and it was worth $5 per ton. After draining the hay produced was worth $15 per ton. It was variously estimated that the drainage work paid for itself in from one to three years.

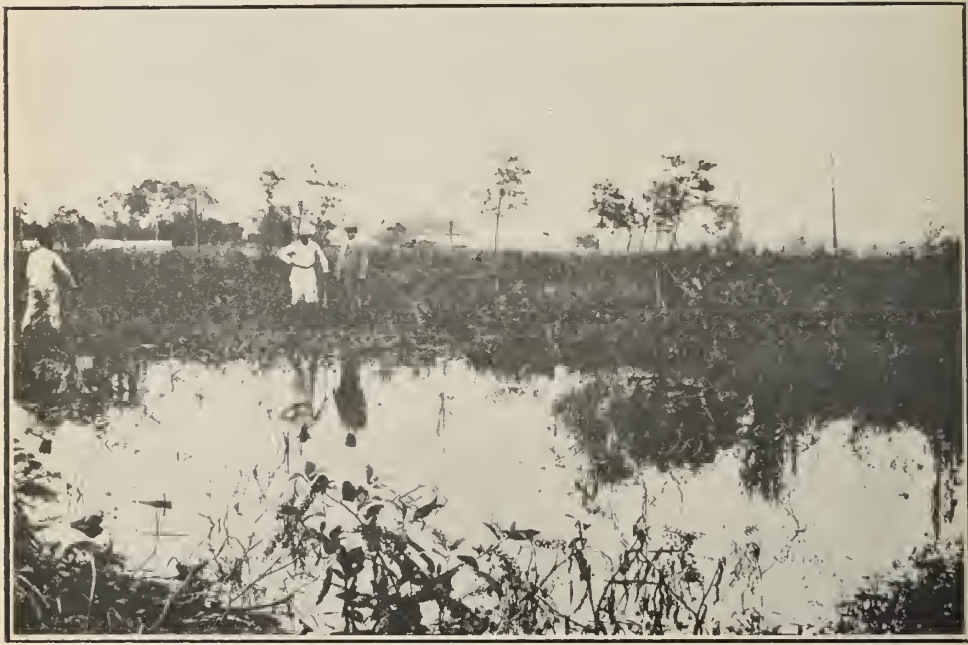

Fig 1.—Wet Land before Draining.

FIELD DRAINS.

In considering drainage the first question to arise is, "How can the best drainage be procured for the least money?" Not a few of the benefits outlined in the previous section are dependent on the close spacing of drains, which latter must be deep enough to collect the water at a depth of several feet below the surface. To accomplish this profitably with open ditches is entirely out of the question, for when the ditches are deep enough to drain the water from the soil they are so wide that large quantities of land are occupied by them, this often amounting to 10 or 15 percent of the total area. A system of small, open ditches is expensive to keep up and unless the weeds are cut every year an extensive source of weed infection is maintained. Again, an open ditch seriously interferes with farm operations. If the loss of time, wear and tear on farm machinery, and the strain on the driver and team due to the turning caused by one open ditch be considered, it is quite possible that the saving resulting from the substitution of a covered drain would readily pay the interest on the additional investment required. Moreover, all of the benefits mentioned in the preceding section cannot be developed by the open ditch system of drainage. The open ditch has its use

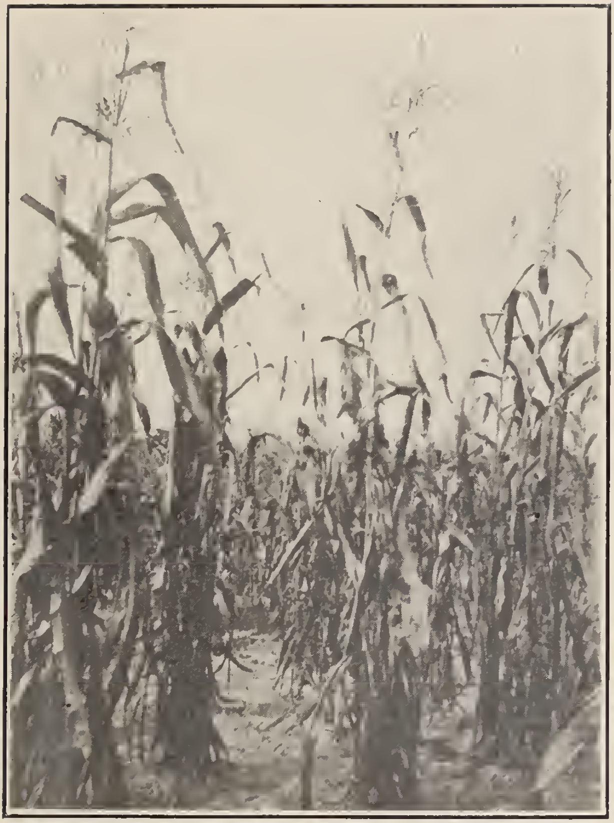

Fig 2.—The Same Spot as in Fig. 1 Two Years Later.

in farm drainage as will be pointed out in a later section, but for reasons given above it is unsuitable for use as a field drain.

An underdrain overcomes every objection that can be made to a field ditch and goes even farther. It will drain a wider strip than will an open ditch. This is easily explained by the fact that the underdrain is installed but once, and the soil pores which form are never disturbed. The soil in the sides of an open ditch is puddled or run together every time the ditch is cleaned, and the earth in the turning row on each bank will become packed, thus hindering percolation of water through it.

Covered drains are made of stone, poles, boards and tile. There are a number of examples showing good results from the use of stone drains, but their chief value is in serving as a means of ridding the fields of loose rock. Poles have been laid in ditches and covered with straw, but the present value of wood will often make the pole drains more expensive than tile. Recent comparative tests show that tile drains have more intensive effect than pole drains and are on the whole preferable to them regardless of the difference in cost. The use of a drain made of boards is now out of the question as a matter of economy. The only remaining material suitable for underdrains is tile. In comparison with the above-named substitutes the tile drain requires a much narrower ditch, thus reducing that cost; it can be more quickly laid; will carry more water for a given cross-section; will remain open where the others become filled; and will not rot. Some tile drains laid in New York State 70 years ago still show no signs of failure and are operating satisfactorily. It is therefore evident that tile is often cheaper in the beginning, and that in any event it will cost less in the long run than the substitutes so often used.

Tiles for underdrains are made from either clay or cement and generally consist of round pipes one or two feet long. The smaller sizes, up to 10 inches in diameter, are usually one foot long, while tiles of larger diameter come in two-foot lengths. Each tile must be so laid that it will discharge the water it receives into the next lower one; this requires that the tiles be laid in a continuous line in the ground so that the water will run by gravity from one section into another. The water leaks into the drain through the spaces (called ''joints'') between the individual tiles, there being no mortar or other cementing material to bind the various pieces together.

Clay Tile.

So far as burning is concerned clay tile may be grouped under the three heads: soft, medium and hard burned or vitrified tile. The first-class includes the common brick tile which are often advertised as ''porous.'' It is true that the walls of the tile are somewhat absorbent, but after the fine pores are filled with water little, if any, passes through the walls of the tile. Tests have shown that after the tile has been in the ground for a few years the pores in the tile become filled with fine soil particles and are rendered useless as affording passage for the water. The term ''porous'' as applied to tile has come to be looked upon only as a poor excuse for insufficient burning. It costs more to burn a kiln of tile to a medium degree of hardness, but earthenware resulting is much stronger and more durable. This latter grade of tile, under all but extreme conditions, will give results as satisfactory as those from vitrified tile and at much less expense. The hard-burned or vitrified tile are best able to withstand freezing because the walls absorb little water and therefore do not split. Of course, any tile will break if reached by frost when the barrel is filled with water and when the adjacent ground is not sufficiently frozen to support them. Hard-burned tile are frequently made from shale rock which is ground up and used as clay; such tile are much stronger than those in general use in Maryland.

Maryland is well supplied with clay that will make excellent tile if the process is properly developed. As the demand for tile increases it will be to the advantage of the brick and tile companies to improve their methods so as to produce good tile as cheaply as possible, thereby increasing the demand for their product. There are some old brick tile near Easton, Talbot County, that were made 40 years ago; they still look as good as new, showing that good tile can be made in Maryland. It is to be hoped that the time will soon come when good clay tile of moderate price will be made in all parts of the State.

Cement Tile.

A number of attempts have been made throughout the State to manufacture cement tile in small quantities, but practically every attempt has resulted in failure. These failures can easily be explained, for they result from the lack of at least one of three essentials, namely, good material, good workmanship and proper curing of the finished product.

The best mortar for making tile is one part of good Portland cement to about three of sand. Mixtures even richer than this have been used. The proportion of one to four has proved satisfactory in places, but it has failed in others. The sand used should be clean and not too fine. A good mixture of medium and large grains gives the best results with the least cement. Fine sand requires a greater amount of cement if satisfactory tile are to be made, while dirty sand has been the cause of many failures. The tiles are molded "dry," so that the forms can be removed very soon after the mixture is tamped into the molds, but the mixture should be of such a degree of wetness that a film of water will show on the side after the tile is tamped and the mould removed. Cement tile should be protected from the sun and air currents for seven days after they are made, and kept moist by sprinkling at frequent intervals. The tile may be cured in sheds or covered with straw or bags to prevent the moisture from evaporating, while they are kept wet by sprinkling the covering three times each day. One week after being made the tile can be placed in piles, but they should not be used until they are at least two months old. Curing by steam vapor is a very effective method of securing good tile, and is used in many large plants. Tile cured by steam for 48 hours can be used at the end of 14 days. Cement tile, as made at present in Maryland, are generally weaker than clay tile of average quality, although when well made they compare very favorably with the clay product. Cement tile are being sold at the same price as clay tile.

The making of concrete tile on the farm is usually attended by some risk to one who has had but little experience with cement and who is not a judge of good sand. Machines for molding tile cost from $20 to $100 in the sizes used by the farmer.

Selection of Tile.

The plain, round tile is the shape preferred by the majority of persons who have had much experience in tile drainage. This is due to the ease with which a tight joint can be had by simply turning the tile in the ditch. Hexagonal and horse-shoe are the other shapes used in Maryland. The hexagonal tile has a round barrel and is more easily laid on a flat-bottom ditch than is the cylindrical tile; however, it is difficult to lay in a round-bottom ditch, a slight shifting permits earth to wash in, and the thin parts of the walls are a source of weakness. The unequal distribution of the material in a tile of any shape other than the round and hexagonal will tend to cause warping when the tile is burned. Hexagonal tile is supplied in Maryland by the Ohio firms using shale, and it is therefore among the hardest tiles used in the State. The hexagonal tile shown at the right in Figure 3

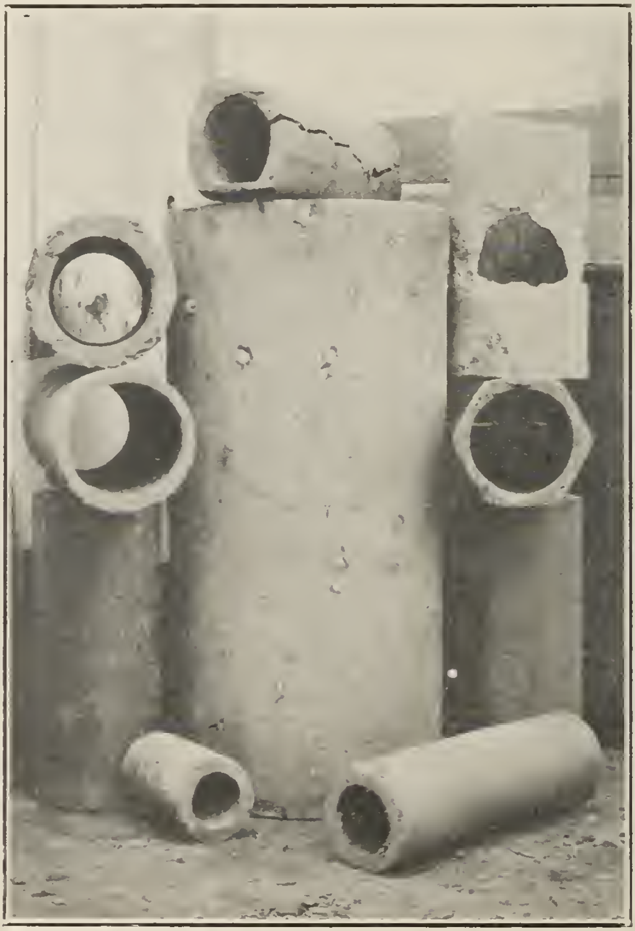

Fig. 3.—Samples of Drain Tile.

is shale tile, while the lower round tile at the left is clay tile that was shipped into the State; both are four-inch (inside diameter). The small sizes on the ground in the foreground of the picture are respectively 2 and 2½ inch clay tile. These must suggest to the reader the difficulty of keeping open a drain constructed of such small tile. Very few tile of these small diameters will be used when the advantages of the slightly larger sizes are known. The large tile shown in the center of the picture is a 2-foot length of 10-inch clay tile. The white spots are specks of lime which were burned with the tile and which tend to weaken it, as the lime often swells when wet, thus splitting the tile. The upper tile at the left is a round tile made in Maryland. The walls are much thicker than those of the sample shown below it, which feature makes the former almost twce as heavy, it weighing 11 pounds to the six pounds of the one with the thinner walls. As both are 4-inch tile there is no difference in efficiency, though the thicker walls make a better joint. However, the extra weight makes the tile more expensive to haul and this is quite an item if freight charges are involved and if the farm is situated any considerable distance from the station.

A local horseshoe-shaped tile is shown at the top of the picture. This shape is one of the oldest in use, and where there is abundant fall to the land it remains open fairly well; but in soils containng fine sand grains where the tile has been laid on a slight grade, it has, in almost every case, become filled with sediment. When there is but little flow in the tile the flat bottom causes the water to spread out and to run in a shallow stream with but small velocity. On the other hand, a round tile draws the water toward the center of the bottom; a much deeper stream is thus formed which runs more rapidly than does the water on the flat surface. The amount of sediment a stream of water can carry varies with the swiftness of flow, in such degree that if the velocity of the current be doubled the water can carry four times as much sediment. It is plain, therefore, that under similar conditions round tile are less likely to become obstructed than are those of the horseshoe shape. Where nothing but horseshoe tile can be had at reasonable prices, careful farmers are laying them with the flat side upward to cause the water to run on the circular part. The horseshoe tile shown has a fire crack extending down the right hand side. It is customary to lay such defective tile with a strip of tar-paper over the crack. They have given good service where used with the round side down and where no breakage has occurred. The risk in using them, however, is far too great under most conditions, and where the cost of the ditch is considered there is but little to be saved by their purchase. Some farmers have gone so far as to cement the cracks, but the expense of doing this would much better be applied to buying good tile. It will be noticed that the under side of the horseshoe tile has been damaged. This was done by the wire employed to cut the tile into lengths as it came from the machine, which as it cut downward, broke off the soft clay from the under side. Good machine work eliminates the greater part of this fault.

A piece of poor cement tile is shown at the upper right hand side of Figure 3. It was removed from a drain after having been in use for two years; the walls had gone to pieces so badly that a large hole, shown in the picture, was found in the side of the tile. The reasons for this failure were the use of fine grained, dirty sand in too large proportions; insufficient tamping; and no curing. It represents the result usually achieved by the man of small experience and little working capital. Good cement tile should look like the upper round tile on the left of the picture.

Farmers along the Potomac River have had second-grade sewer pipe, made for use in Washington, delivered at reasonable prices. The smallest diameter of this pipe is 10 inches; it is salt-glazed and made without bells. This pipe is strong and is giving excellent service. Tile made from fire clay is also shipped into the State but it is very heavy and weak. Square electrical conduit is being used in some places, but it possesses the poor features of the horseshoe tile in that on a flat grade it fills up rapidly with fine material.

All tile, no matter of what material, should be reaonably straight and true in form; it should have well-cut ends and give a metallic ring when struck with something hard.

Depth and Spacing of Drains.

Three feet is the common depth for tile in average soils growing the ordinary crops. The depth may be greater for alfalfa and less for strawberries because of the difference in the root systems.

In draining a pond through a ridge the tile should be laid at least two feet below the bottom of the pond to allow room for plant roots. A greater depth would be advantageous if the cut through the ridge were not thus made too expensive. A common method is to lay the tile at a 2-foot depth and to plow in a circle toward the center of the pond, thus gradually raising the level of the ground.

In a tight "post oak" soil the percolation of water is very slow and of small extent, so that drains but two feet deep are required, while in open loams drains as deep as five feet have proved the most satisfactory. According to Fippin* up to a depth of four feet an increase in the depth of the drain will permit an increase in the interval between drains of about two rods for each foot in depth. For example, a drain four feet deep will drain a strip two rods wider than will a drain three feet in depth, provided, however, that the line be laid in an open soil. The only extra expense is that of an extra foot of digging which is more than offset by the smaller number of laterals required. Where the subsoil is a heavy clay overlain by an open topsoil, it is good practice to lay the tile at least as deep as the line of division. Under these conditions the soil water generally spreads over the subsoil and can be reached only by tile laid as suggested.

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*"Land Drainage in New York," by E. O. Fippin; Circular 70, New York Department of Agriculture.

In the so-called uniform system of drainage (see p. 84) the number of laterals can be greatly reduced if the depth is a maximum for the soil in question; for the laterals must be so closely spaced that no unaffected land will lie between them, and the greater the depth of drain the wider the strip of land affected. In tight, close soils the drains may have to be but two feet deep and 40 feet apart for efficient drainage, while a depth of four feet and a spacing of 200 feet may produce equally good results in a loose open soil.

The amount of coarse sand in the soil is one of the elements controlling the percolation of water. Its presence can best be determined by taking a small piece of soil between the teeth; the sand will be quickly felt. The presence of a "joint clay" formation in the subsoil is a great help to underdrainage as the water will follow the joints. The presence of this type can be detected by digging a test pit; if the subsoil breaks up into small cubes it is said to be of a "joint" formation.

The tight silt loam of the Elkton series of soils seems to be the most difficult soil in the State to drain. Tile spaced close enough to do the work thoroughly would usually cost more than the results would justify. The best solution of the problem is to adopt a ridge and furrow system of cultivation over the field and to grade the furrows as scoop leads or ditches. These should be laid out as nearly parallel as possible, six or eight rods apart, and should be connected to a suitable outlet for surface water. A line of 4-inch tile should then be placed under each scoop ditch and connected to an independent drainage system. If the outlet for the tile is sufficiently deep the tile should be placed two feet below the bottom of the lead, but if this is impossible they should be placed at one side in order to allow for at least two feet of earth over them.

It is customary in orchard work to place lines of tile down alternate rows of trees at a depth of four feet if the outlet will permit such a depth. There is no danger of tree roots entering the tile unless the drain leads from a spring. Orchards are known where the roots from different rows of trees have met and passed yet there has been no stoppage in the tile between them. However, where the tile drains a spring and the line passes within 50 feet of a water-loving tree, special care should be taken to use sewer pipe and to cement the joints to prevent the entrance of roots.

Size of Tile Required.

The laterals are composed of the smallest tile in the system and the size best adapted has in many instances been determined by costly experience. The 4-inch size is the smallest that has given universal satisfaction on the Eastern and Western Shores. It is true that a few 3-inch tiles have been laid south of Baltimore, and have remained open, but they have not run so freely as have 4-inch tile in adjacent fields. Moreover, these 3-inch lines were laid by skilled labor, little of which is now available for such work.

It must be understood that the water in a tile drain runs by gravity because the drain slopes toward the outlet, and that ordinarily there is no pressure whatsoever to force the water through the tile. In other words, the tile does not act under a ''head'' or by so-called ''suction.'' In the light of these facts it is evident that the statement sometimes heard that ''the smaller the tile the faster the water will run'' is a false one.

Years of experience in other States has shown that tile four inches and over in diameter is the best for laterals; in fact, in some localities no tile smaller than the 4-inch is manufactured. In the hilly sections of the State, where skilled ditchers are available, where the soil contains no fine sand or silt and where a fall of one foot in 100 feet can be had on which to lay the tile, laterals as small as three inches in diameter ought to stay open and may give satisfaction; but even under these conditions this size is adapted only to laterals spaced 80 feet apart or closer in clay soil that does not need aeration.

The capacity of the tile in the main line is not made equal to the combined capacities of the laterals, but is determined by, (1) the area drained, (2) fall, (3) the amount of outside water admitted, (4) the number of laterals, and (5) the character of the soil. A few remarks on each of these points will illustrate their significance.

(1) *Area Drained.* The greater the surface which sends water to the main, the larger should be the tile; this will include a hilly area draining to a flat one, though the hilly area may not need drainage.

(2) *Fall.* The greater the fall or slope the smaller the size of pipe required for a given area. For instance, with a fall of 1¼ inches per 100 feet a 6-inch drain will remove ¼-inch of water from 12 acres in 24 hours, under average conditions; but with a fall of nine inches in 100 feet it will do the same for 33 acres.

3. *Amount of outside water admitted.* The main drain of a tile system is often supplied with catch basins to permit surface water to enter the tile directly. If there is a desire to remove all the surface water in a given time, care should be taken to have the main sufficiently large. This will often mean that it must be larger than would be required for underdrainage alone.

4. *Number of laterals.* A single random line of tile has a reservoir composed of the ground which it drains, which reservoir holds the rainfall until the tile can take it away. If the tile is deep in the ground the storage capacity will be correspondingly larger and a slightly smaller tile can be used without injury to crops. There is little storage of water in the case of a regular system of uniform drains, because each lateral discharges into the main within a few hours after the rain falls, the time depending on the texture of the soil.

(5) *Character of Soil.* A larger main and fewer laterals will be required for an open soil which drains readily than for a tight soil.

In view of these five controlling features it is manifestly impossible to lay down hard and fast rules for use in determining the size of a main. The following table of tile sizes for different grades and areas drained is given only as a guide for use under average conditions, though it has proved satisfactory after several years' test in Maryland. It is based on the removal of ¼-inch of rainfall in 24 hours, which requires that some of the water from a storm find outlet over the surface of the ground. If the main is used as an outlet for a pond in a heavy soil, practically all the water that falls in the basin of the pond will pass through the drain and a drain must be provided that will carry at least one inch in 24 hours. The size required in this case is found in the following table by multiplying the actual acreage by four.

AREAS DRAINED BY TILE MAINS.
(Based upon Kutters formula, n=.015.)

Size of tile Inches	Fall per 100 feet			
	1-¼ inches or 0.1 foot	2-⅜ inches or 0.2 foot	3-⅝ inches or 0.3 foot	4-¾ inches or 0.4 foot
	Acres Drained			
4	4	5	7	8
5	7	10	12	14
6	12	17	21	24
7	19	27	33	38
8	28	39	48	56
10	51	71	88	101
12	86	119	147	171
	6 inches or 0.5 foot	9 inches or 0.75 foot	12 inches or 1.0 foot	24 inches or 2.0 foot
	Acres Drained			
4	9	10	12	18
5	16	20	23	32
6	27	33	39	55
7	42	52	59	84
8	62	75	87	122
10	113	140	161	223
12	190	232	268	379

PLAN OF DRAINAGE.

There are various plans or systems of laying out underdrains; the arrangements most widely used in Maryland are known as the random, gridiron, and herringbone systems.

In random draining the tile is laid in single, independent lines which usually spread out and drain wet spots scattered in a number of widely separated places. The lines are usually crooked and are so located as to fit the bottoms of the depression in which they may be laid (see Fig. 4, A). Intercepting or cut-off drains are a form of random drainage; such drains are placed above springy spots to cut off the seepage, thus drying out the ground. Intercepting lines are also driven straight into spring heads for the purpose of draining them.

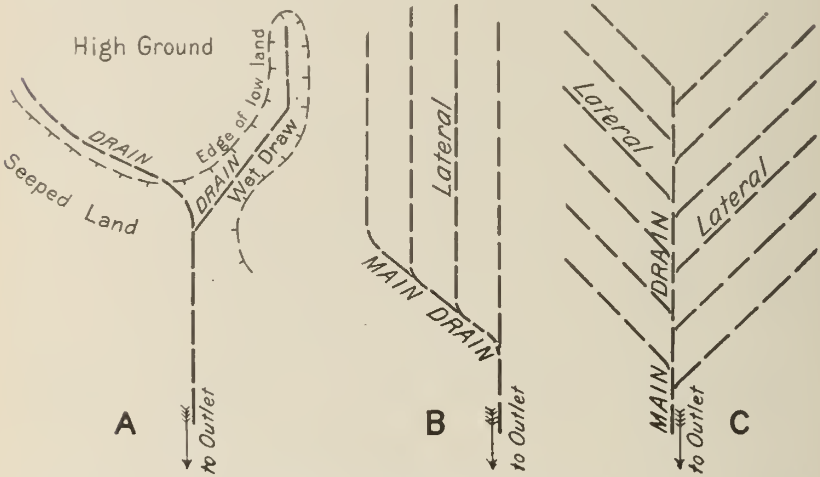


Fig. 4.—Diagrams Showing Systems of Draining. (A) Random System; (B) Gridiron System; (C) Herringbone System.

The gridiron and herringbone systems afford what is known as uniform drainage, as opposed to the irregular drainage supplied by the random systems. These regular systems are composed of a number of parallel lateral lines connected by a main line of tile which receives the water collected by the laterals and discharges it at a suitable outlet.

In the gridiron system (Fig. 4, B), which derives its name from its smilarity in outline to the old-fashioned cooking utensil, all of the laterals lie on one side of the main. The laterals may run either at right angles or slanting to the main. In either case the junction should be made with a Y special, the last 10 or 15 feet of laterals being curved as much as is necessary to make a proper connection. This is the most economical system for thorough drainage where the laterals are long and parallel. Each line of tile, including the main, drains a strip of land of a width depending on the character of the soil, where two lines connect, the soil near them is drained by both lines and is said to be double drained. Double drainage is frequently a useless expense and can be reduced by decreasing the number of junctions to a minimum; this is accomplished by designing the system with long laterals.

The herringbone system (Fig. 4, C), as is implied by its name, has branches on both sides of the main. It might be called the double-gridiron system. It gives, in fact, twice the double drainage of the simple gridiron system. For this reason it is not as economical as the latter, though there are places where such a layout is necessary.

Figure 5 shows a map of a 10-acre field which was underdrained with 4-inch tile. The arrows show the direction of slope of the land, it being such that 12 additional acres drain to the system. There was a small flat between the foot of the slope and the Matthews Road; around the edge of this flat and under the hill were springs. By referring to the map it is seen that the lower part of line C and the upper part of line D act as intercepting drains. The laterals of systems A and D form a gridiron system of drains. The spacing of lines C, D and E varies with the character of the soil and ranges from 40 to 90 feet. The upper ends of the Main and Line C are random drains and run up wet draws; they follow the lowest parts of the depressions. Line B is a short stub run into a spring head; and is, with the laterals in System D, too short for economy in general uniform drainage. Springs necessitated all of the short lines in this latter system.

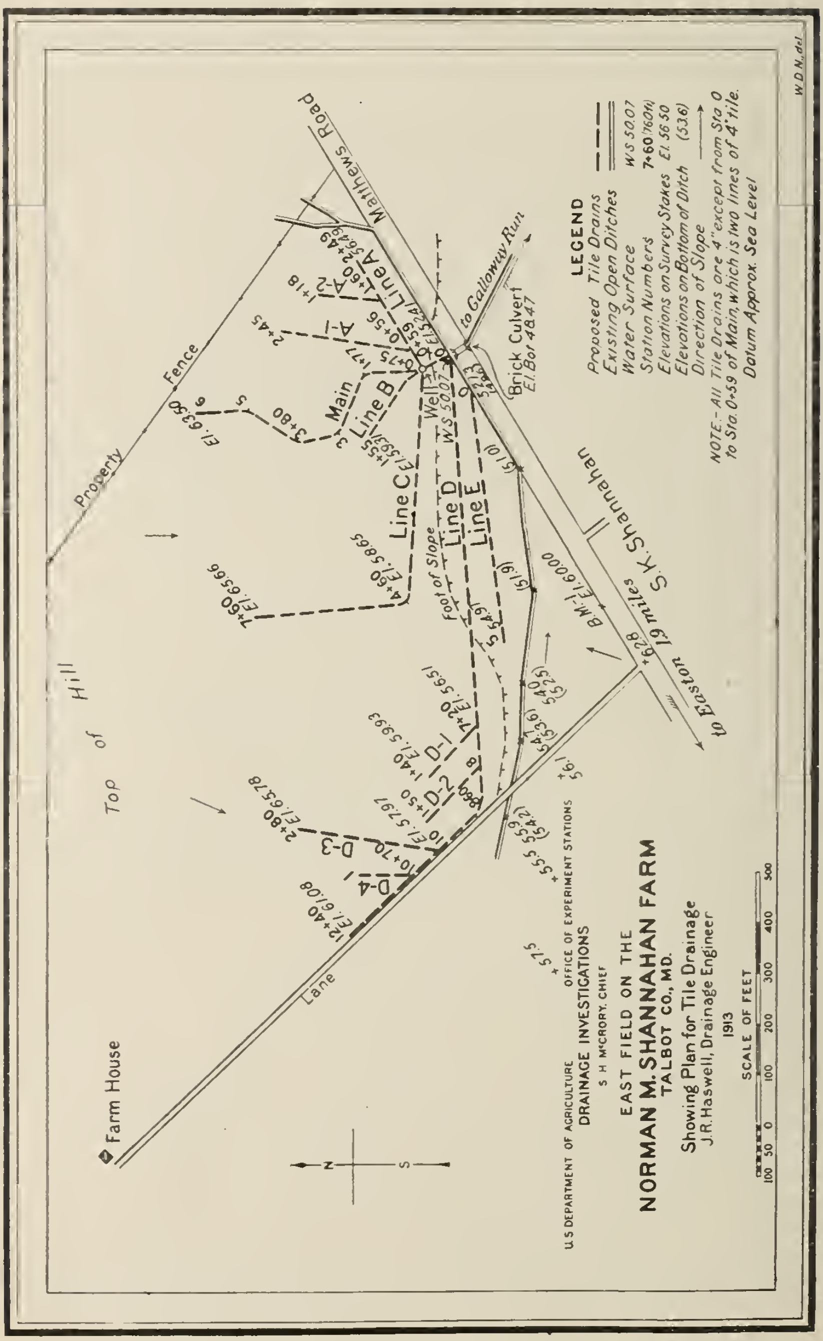


Fig. 5.—Map Showing Typical Tile Drainage System.

As it was desired to watch the work of each line the outlets were arranged as shown on the map. The "well" or silt basin received the flow from four lines; Line D is built into the same outlet headwall as the main running from the well, and Line E empties into the road ditch. The well also serves as a sand trap. Several of the lines draining into it were laid in quicksand, so that every effort was made to give them a free flow and at the same time to remove the sand. The well has accomplished its purpose and after a few years of operation it is expected that sand will cease to run into the tile because the drainage will make it more stable.

The system cost $225.27, or $19.30 per acre of wet land, exclusive of superintendence which was supplied by the farmer, but as there are really 22 acres draining into the tile through the springs the cost should be calculated on that basis, and in that case would be $10.22 per acre. This work has rendered productive a section which formerly detracted materially from the value of the farm.

Vertical drains have proved successful where the sub-strata encountered were open and dry and where care was taken to curb the well substantially. In one place in Queen Anne's County, where a vertical drain was under construction, a water-bearing stratum was discovered under a tight clay and the water rose higher after the well was dug than it stood before. The digging of a well has proved too laborious in some sections and instead a deep post hole curbed with 6-inch drain tile has been substituted. The upper end is covered by a few bricks or broken stone, or a patent drain head can be used. Deep soil borings should be made before any great amount of money is spent on vertical drainage of any kind, in order that an exact knowledge of the sub-surface conditions may be had and a good outlet assured.

OUTLET DRAINS.

Where large quantities of water are to be carried open ditches are required, especially where an outlet for field drains is the object sought. It is true that in some States, where the price of farm land has reached $200 or more per acre, 36-inch tile is being used in the place of open ditches for outlets. In Maryland 12-inch mains are the largest in general use and where a larger capacity is required open ditches are used, though these are not efficient as field drains due to the objections noted in the section dealing with the latter subject.

A number of "tax ditches" have been constructed under the old drainage laws of Maryland. In practically every instance the old run of the stream was followed, no grade was set with a level, the sides were steep and the bottom width not sufficient; all of which conditions have resulted in a system of main outlet ditches that is low in efficiency, expensive to maintain, does not provide deep enough drainage, and in every way is most unsatisfactory. The question therefore arises as to what constitutes a good outlet ditch for field drains.

The ditch should be as straight as possible, with easy curves at the bends, and the bottom should be graded with a uniform slope. The bottom width, even for the smaller ditches, should not be less than four feet, because a narrower ditch will be more difficult to keep open and in the long run will prove more expensive. The sides of the ditch should have slopes at least as flat as one horizontal to one vertical. It is customary to dig the larger ditches with a dredge, in which case the usual side slopes are about one half to one and enough extra bottom width is excavated to allow for a certain amount of caving of the banks as the latter tend to take a flatter slope.

No suggestions are given as to the sizes of ditches necessary to drain given areas, as the work requires the services of an engineer who understands the various affecting conditions and who can set an economical grade. There is one point always to be remembered, however, namely, for good drainage the depth should be at least seven feet.

CONSTRUCTION OF TILE DRAINS.

Laying Out the Drains.

It is always best to plan the entire system of drains before starting construction even if it is not intended to install all of the drains at once. The first step is to take a few levels on the field to be drained. This will give the slopes in the different parts of the field, by the aid of which the most economical system can be worked out. It is customary, where an engineer is employed, to mark the proposed lines of tile with stakes placed 100 feet apart. Small stakes called "hubs" are driven into the earth until they are almost flush with the surface; the surveyor's rod is then held on these. Guard or guide stakes are driven near the hubs and are large enough to be easily seen. The depths of cut necessary to give the trench the proper grade are measured below the tops of the hubs. This method of laying out a trench insures a grade as nearly perfect as is required and does away with the uncertainty caused by the guess-work of those who run levels "by eye."

From the data procured on the survey a map should be made. This should show the tile system and it will thus remain a permanent record, indicating the locations of the lines of tile long after their exact positions have been forgotten. By the use of the map additions may be made and the old tile easily found should circumstances require its re-location. Iron pipes filled with concrete are often set in fence rows to mark the location of tile lines. Attention is again called to Figure 5 for the purpose of indicating what such a map should contain. There should be a title showing the location of the tract, a "compass" to indicate directions, and a statement of the scale that has been used in drawing the map. The explanation of symbols used is often better given in a "legend" than in notes scattered over the drawing. A few elevations and distances along the drains help to illustrate the plan and any fences, roads, buildings, etc., should also be shown on the map as an aid to present and future work.

A small spirit level mounted on a straight edge is sometimes used as a substitute for the surveyor's instrument. When this is done a thin block is placed under the lower end to get the desired grade. A carpenter's level can be mounted on a stake and approximate levels taken by sighting over the upper surface or through sights which are made for the purpose. A fairly accurate farm level may be bought for about $15 and it will pay any person who has much work of this kind to do to procure one. The sighting is done through a telescope which permits of more accurate work at greater distances than is possible with the ordinary mechanic's level. Some ditchers test a slope by placing a small dam in the ditch and measuring the distance which the water is dammed back. The minimum dam is usually one-half inch high and the water is allowed to back up for one rod. This gives a fall of three inches per 100 feet which is the flattest slope that should be given to laterals and is usually considered the least that can be attained with ordinary labor. With skilled help and careful leveling slopes as low as one inch per 100 feet for 4-inch tile and one-half inch per 100 feet for 12-inch tile can be used successfully, but the tile should be increased in size each time the slope is reduced.

Two points must be remembered in deciding on the slope of a drain; these are the general depth required for the particular soil (see ''Depth and Spacing,'' p. 80) and the minimum slope permissible, as discussed in the foregoing paragraph. These two factors usually determine the points at which to break the grade line in changing the slope of a drain, for it is not economical to dig too deep if it can be avoided by changing the slope, nor is it best to bring the tile too close to the surface if the line may be deepened by breaking grade.

As soon as the trenches are laid out the tile should be ordered, because the stakes used are easily lost in an interval of delay. Any change in the stakes will of course render useless the engineer's figures. Some persons prefer to distribute the tile before trenching is started in order to save bridging the ditches at a later time. The tile should always be laid each day as the trenching progresses and they should therefore be distributed along the trench when unloaded. An exception may be made in the case of quicksand which sometimes becomes more stable if left over night and the water allowed to drain from it before laying the tile.

DITCHING.

In ditching a guide rope is stretched on the ground at one side of the stakes and a spade used to mark the line. At all bends in the line the rope should be laid down on the ground in a smooth curve as the trench will be dug to it and any irregularities started at the surface are likely to grow much larger as the trench is deepened.

As before stated the cuts are measured from the tops of the hubs; this gives a grade point on the bottom of the trench every 100 feet. The problem is to dig the trench to grade between these grade points and this is best done by using a string and gage rod to test the work.

The string is stretched at such a distance above the ground that when the upper end of the gage touches the string the lower end is at the grade of the trench, the gage being held in a vertical position. If the gage rod is of the usual length, five feet, the string is then five feet above grade points. A simple way of setting the string is to subtract the depth of the cut from the length of the gage; the difference is the vertical distance of the string above the "hub." The string is supported by cross bars which are shown in Figures 6 and 7. One cross bar is placed over the trench at each stake, the latter being spaced 100 feet apart as noted above. It is necessary to take the sag out of the string by extra cross bars which are adjusted by sighting over those at the stakes. Some ditchers do away with the string and sight over the cross bars to the gage, while others support the string on stakes at the side of the trench and have an arm projecting from the gage to the string. These latter methods are generally unsatisfactory where ordinary labor is used and cause many mistakes. In the first cuts the gage rod may be supplanted by the handle of the round-pointed shovel which is provided with a notch cut in the handle 4½ feet from the point. A gage exactly 5 feet long should be used as the trench is dug nearer to grade. At the extreme right of Figure 6 the trench has not been excavated to grade; the distance which the stick projects above the string shows the remaining cut to be made.

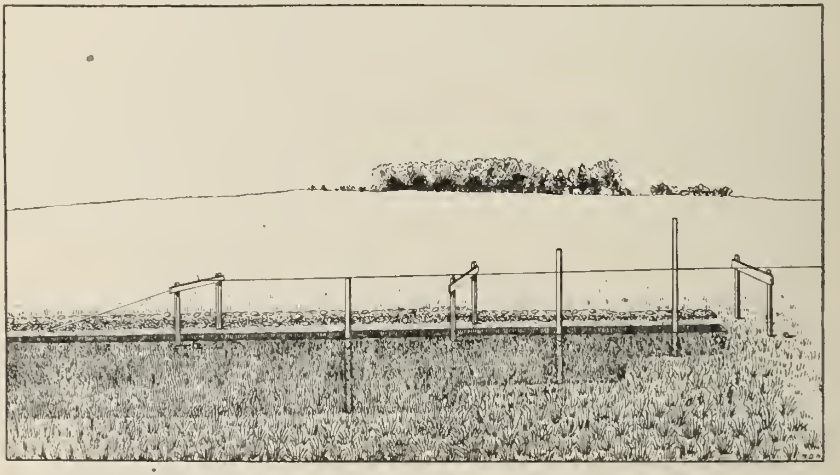


Fig. 6.—Method of Grading Trench with String, Crossbars, and Gage.

In cutting through high ridges it is often necessary to use a longer gage so that the string will not be in the way of the workmen. Rather than cause the confusion incident to changing gage rods, in cutting through a short ridge where the cut is greater than the length of the gage, the 5-foot gage can be retained and the cross bars set below the bank of the trench.

Ditching Tools.—The particular tools of a ditcher are the ditching spade, grading scoop and tile hook, (see Fig. 7) with, of course, the common spade and such picks, shovels, crowbars, etc., as the character of the ground may require. There are so many different types of soil formation that some of the tools required for one job would be of little use on another.

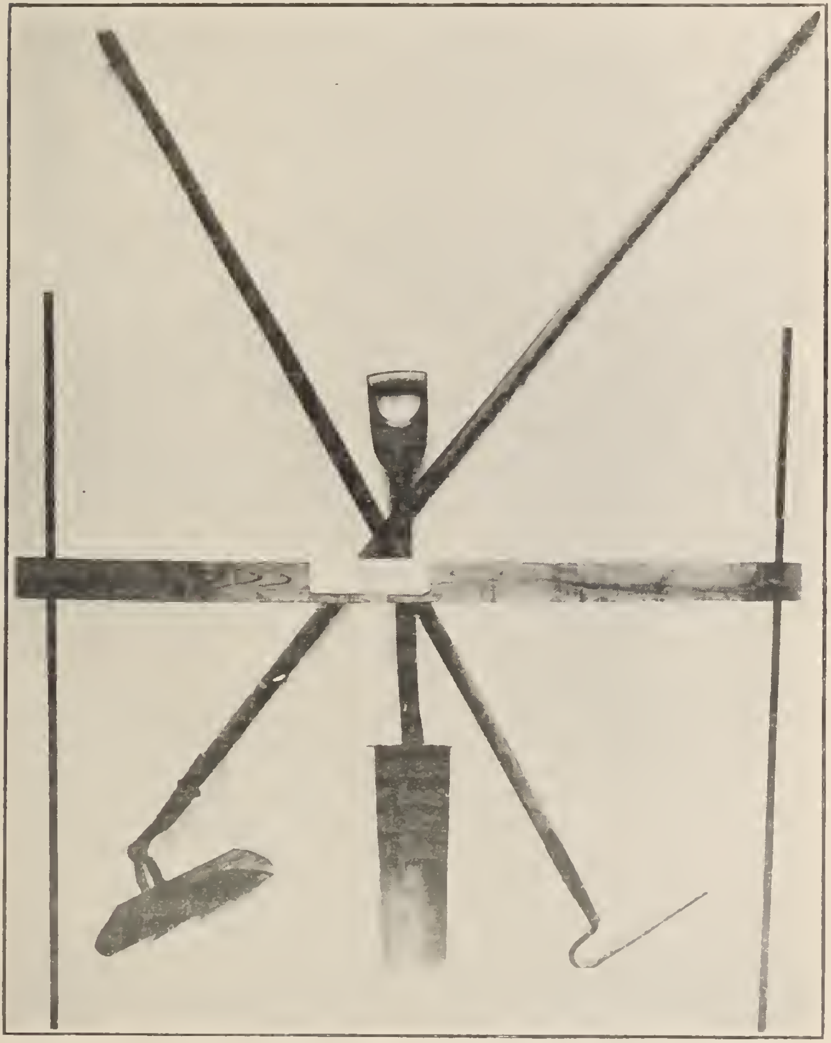


Fig. 7.—Ditching Tools.

The ditching spade has a blade from 18 to 24 inches long and 5 inches wide. It makes the deep, narrow cuts that are necessary for economical tile trenching. The spade is operated by driving it in slightly quartering with the side of the trench and bearing down on the handle to break loose the soil at the bottom.

The grading scoop is mounted on a long handle so that it can be operated from the bank of the trench if necessary. The cutting is done by drawing the scoop toward the workman. The men who make the first cuts should leave as little as possible to be excavated with the scoop, but should on no account cut below the grade line of the trench. The scoop is made round for round tile and flat for hexagonal tile, so that of the finished bed will be of the exact form required to receive whatever kind of tile is used.

In placing the smaller sizes of tile in the trench while he stands on the bank, the workman uses the tile hook. The hook can be used only where the trench has been well prepared and the bottom smoothed. A garden trowel is very convenient for removing rough places in the bottom, especially where the work is in gravelly soil.

Trenching Machines.—Very satisfactory work can be done by trenching machines if the conditions are suitable for their operation. The power machines are of two types with respect to their drive, the heavier having a traction drive, while the other type is drawn forward by a cable. The cable is wound on a windlass mounted on the front of the machine and the forward end is attached to an anchor set in the ground ahead of the machine. This latter type permits the use of much lighter machines than is required for a tractor, and as they are provided with gasoline engines which weigh less than steam equipment they can be used on much softer ground than can traction machines. Horses are used to move them from one job to another. Both types of machines cut a well-graded trench at one passage and are much to be preferred to the usual run of hand labor available in the State. A machine will dig 800 feet of trench, three feet deep, per 10-hour day, if conditions are favorable. Even greater runs than this have been recorded.

Practically all the machine-dug tile trenches for farm drainage in the east have been excavated with the wheel type of machine in which small buckets or knives are mounted on a large revolving wheel. In the West larger machines are used which are equipped with buckets mounted on an endless chain which is lowered into the trench. The buckets are then drawn up the end of the trench and are filled and raised as the machine advances.

The contract price for machine trenching in Maryland is now 22c per rod where the farmer supplies coal and water at a point convenient to the machine. The coal and water average a little over 5c per rod, making the total cost of the excavation 27c per rod. This is only about three-quarters of the amount that hand work would cost were the workmen obtainable.

As trenching machines suitable for use on farms cost about $1,500, there are but few individual farms in the State large enough to justify the purchase of a machine if used privately. It therefore becomes necessary to depend upon other ditching in the neighborhod to pay for the machine.

Various horse-drawn implements which are intended to assist trenching operations are on the market. They range all the way from a straight-sided plow for loosening the earth, to an elevating ditcher which deposits the dirt at the side of the trench. Under favorable conditions they save money, particularly if labor is scarce and powerful horses easily procured. The trench, as left by these machines, must be deepened and graded by hand.

Neither the power nor the horse-drawn machines work well in stony ground and some are only partially successful in cutting a curved trench, but the power machines mentioned above generally give entire satisfaction on reasonably sharp curves.

LAYING THE TILE.

The tile laying should start at the outlet and proceed up the drain. In sandy soil each tile should be turned until the ends meet at the upper side, and in most soils the joint should be as tight as possible. An opening of ⅛-inch is allowable while larger openings should be covered with fragments of broken tile called "bats." In soils containing no fine sand and where experience has shown that the soil will not wash into the tile, a joint as large as ¼-inch may be allowed for the purpose of aeration, but if no aeration is required a tight joint should be insisted upon. Open joints should never be left except by persons well acquainted with the soil being tiled.

Where quicksand or a soft bottom is encountered the tile are best laid on narrow boards or slabs, the joints being covered with a fibrous material such as cheesecloth, burlap, tar paper, straw, etc. Another method is to ram the sods from the upper cut into the bottom of the trench, making a firm bed and thus replacing the boards. Clay is a very good covering for the joints in places where protection from quicksand is needed. After the earth around the tile has settled for a year or two there is very little danger of material filling the tile. A very troublesome case of quicksand was successfully overcome by connecting the tiles with a thick daub of weak lime mortar completely surrounding the joint. In this particular case enough water passed through the mortar to drain the land without permitting the entrance of quicksand.

A curve in the tile line is easily fitted if it is long; but if the curve is short and somewhat abrupt, as in the case of joining the "Y" noted in the discussion of the gridiron system, extra work is required. Material can be chipped from the inside edge of the joint by the judicious use of a hammer or by applying a monkey wrench in a manner similar to the use of the notches in a glass cutter. A very convenient way to make curves is to save all the bent pieces of pipe until needed for this purpose. A test of good workmanship is the neatness with which the ends of the tile are joined on curves.

The use of "Y's" at junctions is strongly urged, as a better working system is obtained than is possible where "T" connections are used. The reason for this is simple: The two streams of water in the "Y" meet while flowing in approximately the same direction and thus there is no obstruction to flow as is the case with the "T."

Where possible there should be a slight drop from the lateral into the main, so that any water running in the main will not back up into the lateral should the latter be empty. The use of the "Y" connection and of the drop tend to prevent the deposit of silt in the tile. The "Y" is best tilted slightly upward toward the lateral, so the drop can be made in the first few feet of tile.

Before backfilling is begun the tile line should be inspected and any joints which appear to be too wide (i. e. over ⅛-inch) should be covered with "bats." These must be firmly wedged in place and covered with soil to prevent them from falling from their position. The upper end of the tile should be closed with "bats," a flat stone, or other durable material, such as slate, brick or glass. A board should never be used as a covering for the end as it will rot and permit the washing of soil into the drain. If the end of the drain is in the bottom of a pond where the soil is tight, the trench can be filled with stones or oyster shells in order to admit the water more rapidly; in this case the end of the tile may be left open.

Backfilling the Trench.

After the tile laying has been inspected and passed the tile are "blinded" by a workman who stands astride the trench and shaves dirt from the sides with a ditching spade. The purpose of "blinding" is to keep the tile from later getting out of line and thus either reducing the flow in the drain or allowing it to fill completely with earth. If the tile are small and the trench is machine-dug, there may be considerable space between the tile and the side of the trench; this should be filled in the blinding operation. A good hand-dug trench is not much wider at the bottom than the tile and is easily blinded. Enough material is placed over the tile to serve as a cushion for the rougher backfill. The loose earth should be packed around the tile and lightly tamped above it.

After blinding the remainder of the dirt can be filled in roughly with shovels or by a team and plow. The best practice is to have a horse on each bank of the trench and connected to the plow by a long evener. One man drives and another turns the dirt into the trench. If the soil is very tight it can be rendered more open by sprinkling lime in the trench and over the excavated material before completing the backfill.

Outlet Protection.

A good outlet is absolutely necessary for every drainage system, for if the outlet is poor the entire system will be only partially successful. In most tile drainage work the outlet is the only exposed part of the system and it is here that the elements cause damage; that stock tramp the tile out of position; and that small animals find an entrance into the tile, later to become lodged and obstruct the flow of water.

The cheapest form of outlet, as far as first cost is concerned, is a board box eight feet long and large enough to permit the insertion of the end of the tile; but this is generally more costly in the end as repairs are soon needed. Sewer pipe can be substituted for the box and four lengths cemented together to prevent their washing out. One-foot lengths of tile should never be used unless a bulkhead is built.

A concrete, brick or rough stone bulkhead is the best means of protecting the outlet end of the tile. This affords complete protection to the tile and is as lasting as the tile itself. The foundation being placed below the bed of the outlet ditch, there is no undermining and the extension of the bulkhead a few feet on each side and above the title prevents caving and washing at the outlet. There should be a step formed in the foundation below the end of the tile so the water will not fall directly on the bottom of the ditch and thus undermine the outlet. Pieces of hard-burned tile or glazed sewer pipe should be used on the exposed end of the pipe to guard against breakage by frost. This is the only place where frost can reach the tile and protection should therefore be afforded. No matter what sort of outlet protection is provided, the end of the tile should be screened to prevent the entrance of small animals such as rabbits and musk-rats. Large size copper wire is suitable for this purpose.

A flap valve or gate is sometimes substituted for the screen. This device is also used to keep out flood or tide water in places where either rises higher than the tile. A gate is not necessary except where water frequently covers the outlet. It is made from wood or galvanized iron and is hinged at the top so that it can rise at low water and permit the tile to empty. Wherever possible the outlet of the tile should be placed so high as not to be submerged for long periods by flood water, because the flow from a submerged outlet is retarded by the pressure from the outside.

Silt Basins.

In the description of Figure 5 attention was called to the well which served as a sand trap. The name "silt basin" is generally used in connection with such an appliance. It consists of a pit under the tile in which silt can collect. It has been pointed out that the faster a stream of water flows the more silt it can carry. The water enters the basin at one side and leaves at another, and as it spreads out in the silt basin the sediment is dropped. A depth of two feet should be allowed below the outlet tile for the collection of silt. The silt basin should of course be cleaned from time to time.

In a location where a drain collects water on a hillside and later runs across a flat the tile will give constant trouble if the soil contains fine sand or silt, provided no attempts are made to collect and remove such silt as may be carried by the water. The slope of the tile on the hillside will cause the water to run swiftly, but where the slope is not so steep much of the silt which has been carried down will be deposited in the tile. A silt basin placed at a change in grade will hold the greater part of the sediment until it can be cleaned out of the basin.

A convenint silt basin is shown in Figure 8. It is made from a 2-foot section of 18-inch sewer pipe, placed below the tile, with bricks or stone laid in cement mortar on the bell and high enough to take in all the tile lines entering the basin. Enough lengths of 24-inch sewer pipe are then placed on the masonry to carry the opening to the surface. A little care in fitting the brick work around the tile will save any chipping of the sewer pipe either for entrance holes or for the lengths of pipe extending to the surface. No sewer pipe smaller than the sizes given above should be used as experience has proved that pipe smaller than 24-inch for the top piece makes the basin troublesome to clean. The earth should be well tamped around the sewer pipe forming the basin.

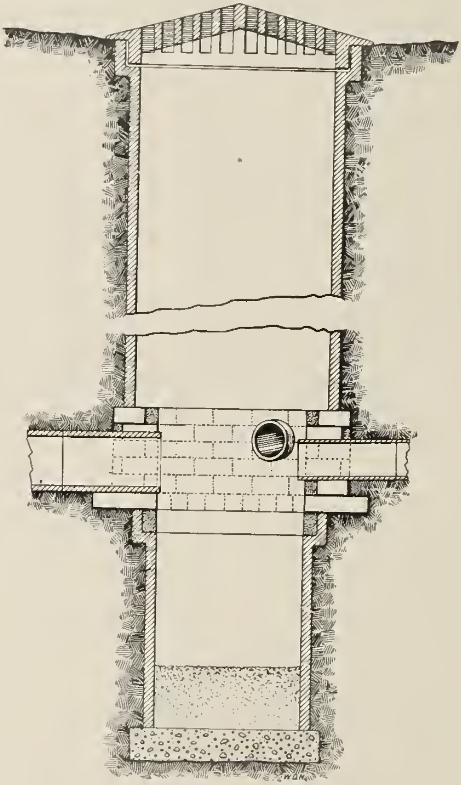


Fig. 8.—Sketch of Silt Basin.

Special sections of pipe with holes in them can be bought but they are rather expensive. If a basin made entirely of sewer pipe is desired, the holes for the tile can be chipped with a cold chisel. The chance of breakage will be lessened if the pipe is stood on end and filled with sand before the holes are cut. The joints of the sewer pipe should be cemented, as well as the connections where the tile enter, in order that no water shall enter except through the grating or through the tile. This will prevent dirt from washing in through the sides of the basin and loosening it.

CATCH BASINS.

Under the topic "Benefits of Drainage" (page 70), attention was called to the fact that field drains are designed to take off only the surplus or gravitational water and that any water needed by crops is held by the soil particles. This is generally provided for by causing the surplus water to percolate through the soil before it reaches the tile and thus any needed water is held. However, it is entirely possible that in depressions, scoop ditches, etc., water will collect faster than it can run through the soil, no matter how well the drains are laid, and in these locations catch basins should be installed.

A catch basin or surface inlet is a device for letting surface water directly into tile drains. It is little needed where the soil is a light sandy loam or where no damage is caused by water standing on the surface for a half day; but where the soil is tight and crops are "scalded," a surface inlet should be provided.

By placing a grating in the top of the silt well shown in Figure 8 this could be used as a catch basin. Both the silt basin and the catch basin should be made frost resisting; they should have gratings or heavy covers and should always be provided with pits to hold an accumulation of sediment.

COST OF TILE DRAINS.

The cost of tile varies greatly in different parts of the State and the prices given below may be expected to vary as much as $5 per 1,000 feet for the tile and $0.10 per rod for the trenching.

APPROXIMATE PRICES OF CLAY DRAIN TILE PER 1,000 FEET.

Size.	*Eastern Shore.*	*Western Md.*	*Wght. per Ft.*
4 inches............	$25	$23	7 pounds
5 inches............	35	32	9 pounds
6 inches............	45	42	11 pounds
7 inches............	58	55	15 pounds
8 inches............	76	72	18 pounds
10 inches............	117	108	29 pounds
12 inches............	144	136	35 pounds

Prices on the Western Shore are about midway between those given.

First quality sewer pipe for use at outlets and as catch basins will cost about as follows if supplied in 2-foot lengths, 2½ and 3-foot lengths costing a little more per foot.

Approximate Prices of Sewer Pipe, Per Foot.

4-inch	$.08
6-inch	.13
8-inch	.18
10-inch	.25
12-inch	.32
18-inch	.60
24-inch	1.00

Cast-iron catch-basin covers to fit the bells of 24-inch sewer pipe. cost $3.50 each.

All of the above costs include freight charges, but in making quotations for tile and sewer pipe the price is given for carload lots. The minimum shipment that will be handled at carload rates is usually 30,000 pounds. An average carload of 4 or 5-inch tile is about 45,000 pounds. The column of weights appended to the above price list for tile is for convenience in estimating the number of tile in a carload. As the weights of any particular size vary slightly with the company manufacturing the tile, exact weights should be learned before placing an order.

The cost of trenching, laying the tile and backfilling has ranged from $0.30 to $0.40 per rod for the smaller sizes of tile. A fair average for the Eastern Shore is $2.00 per 100 feet for placing 4-inch tile up to three feet deep. The cost of ditches through ridges has been close to $0.30 per cubic yard of earth removed for trenches averaging seven feet deep and 14 inches wide at the bottom.

FARM OPERATIONS WHICH ASSIST DRAINAGE.

Some retentive subsoils must be broken by deep plowing before they will permit tile drains to operate freely. A subsoil plow run in the bottom of an ordinary furrow will generally give a total depth of plowing of 18 inches. In some sections, after years of cultivation to the same depth, a "plow pan" or "plow sole" of firmly compacted earth has been formed by the tramping of the horses and the downward pressure of the common moldboard plow. This bed of tightly packed soil must be broken before thorough drainage can be accomplished, and even when underdrains are not installed the good effect of such subsoiling will often be appreciable. Retentive soils are frequently rendered susceptible to drainage by heavy liming. An actual test has shown twice as much percolation where lime was used as was the case in exactly the same soil which was unlimed.

Mention has already been made of silt loams which, because of their tight mechanical structure, present the most difficult soil problems in drainage. The structure prevents the free flow of water to the drains and though lime and deep plowing are of great assistance in opening this type of soil, other steps are often necessary for its complete reclamation. Organic matter is the element needed to give life to such dead soil. This is best applied in barnyard manure or by plowing under green manure crops. Lime will be needed to counteract the acidity caused by the decomposition of these crops and it will also be found useful in correcting the acidity which is generally present in soils immediately after they are drained.

Draining for Mosquito Control.

The vast tidal marshes which are found in the eastern part of the State are covered with shallow ponds which serve as breeding places for mosquitoes. Where the marsh is relatively narrow there is usually found a series of small ponds near the highland, the sections along the creeks and rivers being as a rule more elevated. These high marsh areas are above the average high tide and only the full moon and storm tides rise high enough to flow over them and into the ponds. This gives ample time for mosquitoes to hatch and mature, being protected from fish and other enemies. They will not develop in a body of water to which the tide has daily access. While these salt marsh mosquitoes do not transmit malaria they are so large and fly such long distances in great droves that they are a great nuisance, especially to summer visitors at tidewater resorts.

The malarial mosquito does not travel more than a few hundred yards from its breeding place and as a result the sickness is limited to relatively small areas, though there are enough of these areas to make drainage worth while, even aside from its agricultural benefit.

Open ditch work on tidal marshes is entirely different from that on the interior swamps or wet land. Here the soil is filled with fine roots, being usually underlain by a clay formation at a depth of two or three feet. The lateral ditches are made with vertical sides and are dug through to the subsoil, which presents a good material for the ditch bottom. A width of 10 inches is usual for the laterals and the main outlets are made wide enough to take the flow from the laterals. No attempt is made to grade the ditches as water is expected to be in them at all times which prevents the growth of weeds on the bottom.

In New Jersey work for mosquito control increased hay production enough to pay a good rate of interest. If such simple means are employed as outlined, large stretches of land in Maryland can be made fit for pasture and hay, which at the present time are but a menace to health.

Reclamation of Marshes.

The price of land in the State has hardly reached a point where it will pay to drain by means of pumping. The tidal marshes are not high enough to drain by gravity and the range of tide is not sufficient to make the use of sluice gates and dikes profitable for large areas. Small tidal creeks can be made to pass through sluices and high tides can be kept out with moderately expensive dikes. Such work will prove profitable but should not be undertaken without some engineering assistance. Further information on this type of reclamation may be had from Bulletin No. 240 of the Office of Experiment Stations, United States Department of Agriculture. This bulletin contains data relative to embanking, from both an engineering and a business standpoint.

The Maryland Drainage Law.

The old tax-ditch law which was mentioned under "Outlet Drains" (page 87) is very defective in a number of ways, and under it probably more money has been wasted on narrow ditches than has been spent in efficient and permanent construction. Under this law no engineering advice is required, no positive way is given by which assessments can be collected, and a man can "work out" his share of the cost. This latter provision permits imperfect construction and poor maintenance.

A new drainage law was passed at the 1912 session of the Legislature of Maryland (Chap. 656, Acts of 1912). Under the provisions of this law it will be possible for the people to cooperate to the fullest extent in digging large outlet ditches and in constructing pumping and dike systems. A majority of the people owning the land which it is proposed to benefit are required to petition the county commissioners for authority to establish a drainage district and to issue bonds on the land benefited as collateral. They elect three drainage commissioners who have charge of the bonding, the letting of the contract for the work, and the maintenance of the ditches after construction. The county treasurer is empowered to receive from the owners of the land benefited the installments of principal on the bonds as they come due. The first installment becomes due in three years, and the bonds are paid up with interest in ten yearly payments. This will enable the people to receive some benefit from the work before all of the installments are paid. Landowners must be remunerated for property taken or injured for the public good, and conversely every person must pay for the benefits conferred upon him. These benefits are graded into five classes and the land is taxed proportionately. The classification is made according to the wetness of the land, the proximity to the outlet, and the value of the land; it is so graded that the land receiving the most benefit is taxed five times more than the land with the least improvement. Cooperation with the State and county road officials is provided for and the right to condemn land for an outlet is given.

It is expected that with the help of this law much larger drainage projects, having for their objects the improving of lands for agricultural purposes will be undertaken; and incidentally the number and extent of breeding place for mosquitoes will be much reduced, resulting in increased agricultural production and improved general healthfulness in the locality where the drainage work is undertaken.

The above brief outline of the new drainage law is illustrated by the accompanying diagram (Figure 9). Each action relating to the "Area Needing Drainage" is shown in that section of the diagram, while the county commissioners have charge of all the functions noted in the upper rectangle. The Circuit Court is used to settle differences between the owners and the county commissioners and cannot be classed with either; it is therefore placed in a separate position. Each step in the law is shown by an arrow pointing in the direction which the step is taken and these steps are numbered in order from the start to the finish. The complete drainage law is appended and is easily understood if read in connection with the diagram.

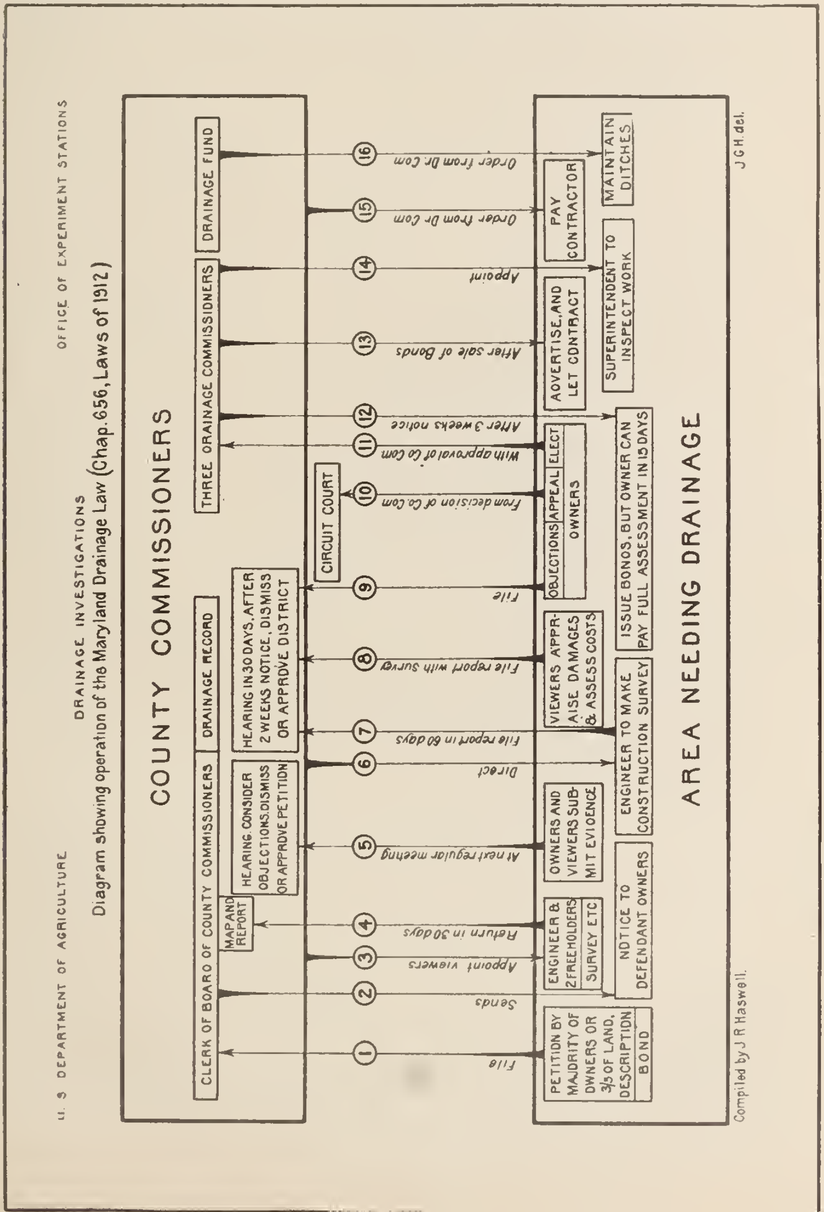

U. S. DEPARTMENT OF AGRICULTURE
OFFICE OF EXPERIMENT STATIONS
DRAINAGE INVESTIGATIONS
Diagram showing operation of the Maryland Drainage Law (Chap. 656, Laws of 1912)
COUNTY COMMISSIONERS
CLERK OF BOARD OF COUNTY COMMISSIONERS
MAP AND REPORT
HEARING. CONSIDER OBJECTIONS. DISMISS OR APPROVE PETITION
DRAINAGE RECORD
HEARING IN 30 DAYS, AFTER 2 WEEKS NOTICE, DISMISS OR APPROVE DISTRICT
CIRCUIT COURT
THREE DRAINAGE COMMISSIONERS
DRAINAGE FUND
① File
② Sends
③ Appoint viewers
④ Return in 30 days
⑤ At next regular meeting
⑥ Direct
⑦ File report in 60 days
⑧ File report with survey
⑨ File
⑩ From decision of Co. Com
⑪ With approval of Co. Com
⑫ After 3 weeks notice
⑬ After sale of Bonds
⑭ Appoint
⑮ Order from Dr. Com
⑯ Order from Dr. Com
PETITION BY MAJORITY OF OWNERS OR 3/5 OF LAND, DESCRIPTION
BOND
NOTICE TO DEFENDANT OWNERS
ENGINEER & 2 FREEHOLDERS SURVEY ETC
OWNERS AND VIEWERS SUBMIT EVIDENCE
ENGINEER TO MAKE CONSTRUCTION SURVEY
VIEWERS APPRAISE DAMAGES & ASSESS COSTS
ISSUE BONDS, BUT OWNER CAN PAY FULL ASSESSMENT IN 15 DAYS
OBJECTIONS
APPEAL
ELECT
OWNERS
ADVERTISE, AND LET CONTRACT
SUPERINTENDENT TO INSPECT WORK
PAY CONTRACTOR
MAINTAIN DITCHES
AREA NEEDING DRAINAGE
Compiled by J R Haswell.
J G H. del.

Fig. 9.—Diagram Showing Operation of Maryland Drainage Law.

NOTE BY THE DIRECTOR.

There are a great many acres of land in Maryland now under cultivation that would be much benefitted by drainage, and farmers should give more study to this subject as presented in this bulletin. In many cases land is more in need of drainage than of fertilizer, and farmers are throwing away much labor and money by continuing to cultivate poorly drained soils.

We frequently have inquiries as to where tile can be purchased, and in order to have this information available, we append herewith a list of dealers and manufacturers.

LIST OF TILE MANUFACTURERS AND DEALERS.

Baltimore Terra Cotta Works, Baltimore, Md.
William Wirt Clark & Son, Baltimore, Md.
Maryland Lime & Cement Co., Baltimore, Md.
Berlin Brick Co., Berlin, Md.
Peninsula Brick Co., Glen Perdue, Mgr., Salisbury, Md.
Salisbury Brick Co., Salisbury, Md.
Somerset Tile Co., Princess Anne, Md.
Francis M. Wilson, Pocomoke, Md.
L. J. Swartzentruber, Oakland, Md.
Potomac River Clay Works, Alexandria, Va.
Thomas Somerville Co., Washington D. C.
Charles Warner Co., Wilmington, Del.
Gettysburg Drain Tile Works, Gettysburg, Pa.
Akron Vitrified Clay Mfg. Co., Akron, Ohio.
American Sewer Pipe Co., Akron, Ohio.
Robinson Clay Products Co., Akron, Ohio.
The E. Biglow Co,, New London, Ohio.
National Fire Proofing Co., Pittsburg. Pa.
Louisville Brick and Tile Co., Louisville, Ohio.
The Joshua Oaks and Sons Co., Haverhill, Ohio.
T. L. Bilbrough and Brother, Greensboro, Md.
Lorenz Tile Co., Cheswold, Del.

This list of tile dealers and manufacturers is not presumed to be complete, but represents all those concerns whose address were at hand and who replied to a circular letter of inquiry. The State Experiment Station would be glad to know of any other firms.

BOOKS AND BULLETINS ON DRAINAGE.

Jones, E. R. The Right Drain for the Right Place. Wis. Sta. Bulletin 229 (1913), Madison, Wis.

Fippin, E. O. Land Drainage in New York. Circular 70, N. Y. Dept of Agriculture (1913), Ithaca, N. Y.

Jeffery, J. A. Tile Drainage. Michigan Agricultural College Sta. Bulletin 56 (1911), East Lansing, Mich.

Day, W. H. Farm Drainage Operations. Ontario Dept. of Agriculture, Bulletin 175 (1909), Guelph, Ontario, Canada.

Burdick, R. T. The Principles of Land Drainage. Vermont Station Bulletin 173 (1913), Burlington, Vt.

Lyon, T. L., and Fippin, E. O. The Principles of Soil Management (1909), The Macmillan Co., New York.

Elliott, C. G. Engineering for Land Drainage (1912). John Wiley & Sons, New York.

Garrison, W. D. Reclamation of Crawfish Lands. South Carolina Agricultural Experiment Station Bulletin 167, Clemson College, South Carolina.

Okey, Charles W. The Wet Lands of Southern Louisiana and Their Drainage. Bulletin 71, U. S. Dept. of Agriculture.

APPENDIX.

THE MARYLAND DRAINAGE LAW.

Chapter 656, Page 980, Acts 1912.

(With Marginal Notes.)

AN ACT to promote the public health, convenience and welfare, by leveeing, ditching and draining the wet, swamp and overflowed lands within the State, and providing for the establishment of levee or draining districts for the purpose of enlarging or changing any natural water courses, and for digging ditches or canals for securing better drainage or providing better outlets for drainage, for building levees or embankments and installing tide gates or pumping plants for the reclamation of overflowed lands, and prescribing a method for so doing; and providing for the assessment and collection of the cost and expense of the same, and issuing and selling bonds therefor, and for the care and maintenance of such improvements, when constructed.

County Commissioners may establish levee or drainage districts.

Drainage a public benefit.

Section 1. That the Board of County Commissioners of any County in the State of Maryland shall have jurisdiction, power and authority to establish a levee or drainage district or districts in their county, and to locate and establish levees, drains or canals, and cause to be constructed, straightened, widened or deepened any ditch, drain or water course, and to build levees or embankments and erect tide-water gates and pumping plants for the purpose of draining and reclaiming wet, swamp or overflowed lands; and it is hereby declared that the drainage of swamps and the drainage of the surface water from agricultural lands and the reclamation of tidal marshes shall be considered a public benefit and conducive to the public health, convenience, utility and welfare.

Petition to establish district.

Bond for cost of proceeding.

Summons to be served on landowners.

Sec. 2. That whenever a petition signed by a majority of the resident landowners in a proposed drainage district or by the owners of three-fifths of all the land which will be affected by or assessed for the expense of the proposed improvements shall be filed in the office of the Clerk of the Board of County Commissioners of any county in which a part of said lands are located, setting forth that any specific body or district of land in the county and adjoining counties, described in such a way as to convey an intelligent idea as to the location of such land, is subject to overflow or too wet for cultivation, and the public benefit or utility, or the public health, convenience or welfare will be promoted by draining, ditching or leveeing the same, or by changing or improving the natural water courses, and setting forth therein, as far as practicable, the starting point, route and terminus and lateral branches, if necessary, of the proposed improvement, and there is filed therewith a bond for the amount of fifty dollars per mile for such mile of the ditch or proposed improvement, signed by two or more sureties or by some lawful and authorized surety company, to be approved by the Board of County Commissioners and conditioned for payment of all costs and expenses incurred in the proceedings in case the board does not grant the prayer of said petition, the said clerk shall issue a summons to be served on all the defendant landowners who have not joined in the petition and whose lands are included in the proposed drainage districts. The summons may be served by publication as to any defendants who cannot be personally served as provided by law. When a mortgage is held on land within the proposed drainage district, notice shall be given to the holders of mortgages in all respects as is provided in this Act for defendant landowners, and they shall have the right to appear before the Commissioners in person or by counsel. Upon the return day the said Board of County Commissioners shall appoint a disinterested and competent civil and drainage engineer, who shall be recommended by the State Drainage Engineer (or if there is no Drainage Engineer, then by the State Roads Engineer), and two resident freeholders of the county or counties in which said lands are located as a board of viewers to examine the lands described in the petition and make a preliminary report thereon. When the lands proposed to be drained and created into a drainage district are located in two or more counties the Board of County Commissioners of either county shall have and exercise the jurisdiction herein conferred, and the venue shall be in that county in which the petition is first filed.

Board of viewers appointed, with civil and drainage engineer.

Jurisdiction when land is in more than one county.

Sec. 3. That the Board of Viewers appointed under Section 2 shall at once proceed to make a careful and thorough examination of the lands described in the petition, and other land if necessary to locate properly such improvement or improvements as are petitioned for, along the route described in the petition or any other route answering the same purpose, if found more practicable or feasible, and shall see that the lands of all who desire to come within the drainage district have been included within said district, and they may make surveys necessary to determine the boundaries and elevation of the several parts of the district, and to enable them to form a tentative plan for development, and shall make and return to the Clerk of the Board of County Commissioners, to be placed on public file in his office within thirty days, unless the time shall be extended by the board, a written report, which shall set forth:

Board of viewers to examine lands and route.

1. Whether the proposed drainage is practicable or not.
2. Whether it will benefit the public health or any public highway or be conducive to the general welfare of the community.
3. Whether the improvement proposed will benefit the lands in question sufficiently to warrant the probable expenditure.
4. Whether or not all the lands that will be benefited are included in the proposed drainage district.

Requirements of report.

They shall also file with their report a map of the proposed drainage district, showing the location of the ditch or ditches, or other improvements to be constructed, with an approximate estimate of the cost, and the lands with the owners' names, so far as they can be learned, that will be affected thereby, and such other information as they may have collected that will tend to show the correctness of their findings.

Map to be filed.

Sec. 4. That the Board of County Commissioners shall consider this report at their first meeting, the engineer and other two viewers being present. If the viewers report that the drainage is not practicable, or that it will not benefit the public health, or any public highway, or be conducive to the general welfare of the community, and the Board of County Commissioners shall approve such finding, the petition shall be dismissed at the cost of the petitioners. If the report of the viewers is favorable to the project, and the Board of County Commissioners shall so find after hearing all the evidence, they shall make such recommendations as they think proper to the viewers, and direct them to make a complete survey, plans and specifications, and estimate of cost for the tiles, drains or levees, or other improvements, and fix a time when said engineer and viewers shall complete and file their final reports, not exceeding sixty days, unless extended by the Commissioners in writing.

County Commissioners consider report at first meeting.

Petition dismissed if work is not practicable and beneficial.

Final survey ordered if report is favorable.

Viewers' final report to be filed in 60 days.

Engineer and viewers may employ assistants.

Instructions for making survey, map and profiles.

Sec. 5. That the engineer and viewers shall have power to employ such assistants as may be necessary to make a complete survey of the drainage district, and shall enter upon the ground and make a survey of the main drain or drains and all their laterals. The line of each ditch, drain or levee shall be plainly and substantially marked on the ground. The course and distance of each ditch shall be carefully noted and sufficient notes made, so that it may be accurately platted and mapped. A line of levels shall be run for the entire work, and sufficient data secured from which accurate profiles and plans may be made for each of the proposed drains or levees. Frequent bench marks shall be established along the line, on permanent objects, and their elevation and full description recorded in the field books and their location shown on the map. If it is deemed expedient by the engineer and viewers, other levels may be run to determine the fall from one part of the district to another. If an old water course, ditch or channel is being widened, deepened or straightened, it shall be accurately cross-sectioned, so as to compute the amount of cubic yards saved by the use of such old channel. A drainage map of the district shall then be completed, showing the location of the ditch or ditches and other improvements, and the boundary, as closely as may be determined by the records, of the lands owned by such individual landowner within the district. The location of any railroads or public highways and the boundary of any incorporated towns or villages within the district shall be shown on the map. There shall also be prepared to accompany this map a profile of each levee, drain or water course, showing the surface of the ground, the bottom or grade of the proposed improvement, and the number of cubic yards of excavation or fill in each mile or fraction thereof, and the total yards in the proposed improvement and the estimated cost thereof, and plans and specifications and the cost of any other work required to be done.

Board of viewers assess damages separate from benefits.

Sec. 6. That it shall be the further duty of the engineer and viewers to assess the damages claimed by any one that is justly right and due to them for land taken or for inconvenience imposed because of the construction of the improvement and the establishment of the drainage district, or for any other legal damages sustained. Such damage shall be considered separate and apart from any benefit the land would receive because of the proposed work, and shall be paid by the Board of Drainage Commissioners when funds shall come into their hands, as hereinafter set forth.

Viewers to classify lands according to benefits, based upon wetness, outlet and fertility.

Five classes.

Number of acres in each class to be ascertained.

Scale of assessment against the classes.

Sec. 7. That it shall be the further duty of the engineer and viewers to personally examine the land in the district and classify it with reference to the benefit it will receive from the construction of the levee, ditch, drain or water course or other improvement. In the case of drainage, the degree of wetness of the land, its proximity to the ditch or a natural outlet and the fertility of the soil shall be considered in determining the amount of benefit it will receive by the construction of the ditch. The land benefited shall be separated into five classes: The land receiving the highest benefit shall be marked "Class A;" that receiving the next highest benefit "Class B;" that receiving the next highest benefit "Class C;" that receiving the next highest benefit "Class D;" and that receiving the smallest benefit "Class E." The holdings of any one landowner need not necessarily be all in one class, but the number of acres in each class shall be ascertained, though its boundary need not be marked on the ground or shown on the map. The total number of acres owned by one person in each class and the total number of acres benefited shall be determined. The total numbers of acres of each class in the entire district shall be ascertained and presented in tabulated form. The scale of assessment upon the several classes of land returned by the engineer and viewers shall be in the ratio of five, four, three, two and one; that is to say, as often as five miles per acre is assessed against the land in "Class A" four mills per acre shall be assessed against "Class B," three mills per acre in "Class C," two mills per acre in "Class D," and one mill per acre in "Class E." This shall form the basis of the assessment of benefits to the lands for drainage purposes, and the basis of all future assessments, taxes, levies and costs connected with the drainage district, except as the same may be modified or changed under order of the Board of County Commissioners at the time of the final hearing or to conform to any decree of the Courts.

Sec. 8. That the engineer and viewers appointed under this Act shall at all times keep an accurate account and report to the Board of County Commissioners the name and number of days such person was employed on the survey and the kind of work he was doing and any expenses that may have been incurred in going to and from the work, and the cost of any supplies or material that may have been used in making the survey.

Account of expenses to be kept for County Commissioners.

Sec. 9. That when the final report is completed and filed it shall be examined by the Board of County Commissioners, and if it is found to be in due form and in accordance with the law it shall be accepted, and if not in due form it may be referred back to the engineer and viewers, with instructions to secure further information, to be reported at a subsequent date to be fixed by the board. When the report is fully completed and accepted by the board a date not less than thirty days thereafter shall be fixed by the board for the final hearing upon the report, and notice thereof shall be given by publication in a newspaper of general circulation in the county and by posting a written or printed notice on the door of the courthouse and at five conspicuous places throughout the district, such publication to be made for at least two weeks before the final hearing. During this time a copy of the report shall be on file in the office of the Clerk of the County Commissioners, and shall be open to the inspection of any landowner or other person interested within the district.

Viewers' final report to be examined by County Commissioners.

Final hearing in not less than 30 days.

Publication of notice.

Report open for inspection in County Commissioners' office.

Sec. 10. That it shall be the duty of the Clerk of the Board of County Commissioners to summon or cause to be summoned all defendant landowners, who have not signed the petition, when they are known to him or to the viewers, and if it shall appear to the clerk by affidavit or otherwise that the owner or owners of the whole or any share of any tract or tracts of land whose names are unknown and cannot, after due diligence, be ascertained by the petitioners, the clerk shall give notice in the nature of a summons to be given to all such persons by publication of the petition or of the substance thereof, and describing generally the tract or tracts of land as to which the owner or owners are unknown, with the order of the commissioners thereon, in some newspaper published in the county wherein the land is located. Such notice shall name the day upon which the Board of County Commissioners will hold their final hearing before declaring the drainage district established. This notice shall be printed for four consecutive weeks prior to the date of the hearing.

Landowners not signing petition to be summoned.

Unknown landowners summoned by publication.

Sec. 11. That at the date set for hearing any landowner may appear in person or by counsel and file his objection in writing to the report of the viewers; and it shall be the duty of the board to carefully review the report of the viewers and the objections filed thereto, and make such changes as are necessary to render substantial and equal justice to all the landowners in the district. If, in the opinion of the board, the cost of construction, together with the amount of damages assessed, is not greater than the benefits that will accrue to the land affected, the board shall confirm the report of the viewers, and declare the drainage district as established. If,

Landowners may appear and file objections in writing.

Board to review report and objections.

Approval of report.

however, the board finds that the cost of construction, together with the damages assessed, is greater than the resulting benefit that will accrue to the lands affected, the board shall dismiss the proceedings at the cost of the petitioners, and the sureties upon the bond so filed by them shall be liable for such costs.

Dismissal of proceedings at cost of petitioners.

"Drainage Record" by Clerk of Board.

Copies of reports, maps, and profiles on file, open to inspection.

Sec. 12. That the Clerk of the Board of County Commissioners shall provide a suitable book, to be known as the "Drainage Record," in which he shall transcribe every petition, motion, order, report, judgment or finding of the board in every drainage transaction that may come before it in such manner as to make a complete and continuous record of the case. Copies of all the maps and profiles are to be furnished by the engineer and marked by the clerk "Official Copies," which shall be kept on file by him in his office, and open to inspection.

Board of Drainage Commissioners.

Sec. 13. That after the said drainage district shall have been declared established, and the survey and plan therefor approved, the Board of County Commissioners shall appoint three persons who are freeholders, who shall be designated as the Board of Drainage Commissioners for that district. These Commissioners shall be appointed subject to the written approval of a majority of the landowners in the district, and any vacancy occurring shall be filled in like manner.

Drainage Commissioners incorporated.

County treasurer ex-officio of district.

Seal.

The three drainage commissioners, when appointed, shall be and shall organize as a corporate body, under the name and style of "The Board of Drainage Commission of........District," with the right to hold property, and convey the same, to sue and be sued, and shall possess corporate powers. They shall organize by electing from among their number a chairman and a vice-chairman. They shall elect a secretary either within or without their body. The treasurer of the county in which the proceeding was instituted shall be ex-officio of such drainage commissioners. Such board of drainage commissioners shall adopt a seal, which they may alter at pleasure.

Superintendent of construction.

Bond required.

Sec. 14. That the Board of Drainage Commissioners shall appoint a competent person as superintendent of construction. Such person shall furnish a bond to be fixed and approved by the commissioners, conditional upon the honest and faithful performance of his duties, such bond to be in favor of the board of drainage commissioners. They shall fix his compensation, and may terminate the contract whenever they consider his services no longer necessary.

After assessments are confirmed and appeals to Circuit Court adjudicated, total cost shall be ascertained.

Sec. 15. That after the classification of lands and the ratio of assessment of the different classes to be made thereon has been confirmed by the Board of County Commissioners at the time of the final hearing, and any appeal that may have been made to the Circuit Court has been adjudicated, the Board of Drainage Commissioners shall ascertain the total cost of the improvement, including damages awarded to be paid owners of land. All costs and incidental expenses, compensation of engineer, viewers and assistants, and also including an amount sufficient to pay the superintendent of construction, and expenses of the commissioners, and the necessary expenses of maintaining the improvement for a period of three years after the completion of the work of construction, and for the payment of the interest on the drainage bonds for a period of three years, and thereupon the Board of Drainage Commissioners, under the hand of the chairman and the secretary of the board, shall certify to the Clerk of the Board of County Commissioners the said total estimated cost, and the said certificate shall be recorded in the drainage record, and be open to the inspection of any landowner.

Board of Drainage Commissioners to prepare, in duplicate, ten assessment tax rolls.

Sec. 16. That when the Board of Drainage Commissioners for a district shall have made their estimate of the total cost of the improvement according to Section 15 it shall be their duty to immediately prepare, in duplicate, ten assessment rolls, or drainage tax lists, to cover the period of the bond issue, giving thereon the names of the owners of land in the district, so far as can be ascertained from the public records, a brief description of the several tracts of land assessed, and the amount of the assessment against each tract of land. The first of these assessment rolls shall provide assessment sufficient for the payment of interest on the bond issue to accrue the third year after their issue and the installment of principal to fall due at the expiration of the third year after the date of issue, together with such amounts as shall have to be paid for collection and handling of the same. The second assessment roll shall make like provisions for the fourth year; the third for the fifth year; the fourth for the sixth year; the fifth for the seventh year; the sixth for the eighth year; the seventh for the ninth year; the eighth for the tenth year; the ninth for the eleventh year; the tenth for the twelfth year. Each of said assessment rolls shall specify the time when collectible and be numbered in their order, and the amounts assessed against the several tracts of land shall be in accordance with the benefits received, as shown by the classification and ratio of assessments made by the viewers. These assessment rolls shall be signed by the chairman of the Board of Drainage Commissioners and by the secretary of the board. One copy of each of the said assessment rolls shall be filed with the drainage record and one copy shall be delivered to the sheriff, or other county tax collector, after the Clerk of the Board of County Commissioners has appended thereto an order directing the collection of said assessments, and the said assessments shall thereupon have the force and effect of a judgment as in the case of State and county taxes. These assessments shall constitute a first and permanent lien, second only to State and county taxes, upon the lands assessed for the payment of said bonds and interest thereon as they become due, and shall be collected in the same manner by the same officers as the State and county taxes are collected. The said assessments shall be due and payable on the first Monday in January each year, and if the same shall not be paid in full by the thirty-first day of April following, it shall be the duty of the sheriff or tax collector to sell the land or lands so delinquent. The sale of lands for failure to pay such assessments shall be made at the courthouse door of the county in which the lands are situated, between the hours of ten o'clock in the forenoon and four o'clock in the afternoon. The existing law as to the collection of State and county taxes shall have application to the collection of drainage assessments under this Act. It shall be the duty of the sheriff or tax collector to pay over to the county treasurer promptly the moneys so collected by him upon said tax assessments, to the end that the said treasurer may have funds in hand to meet the payments of interest and principal due upon the outstanding bonds as they mature. It shall be the duty of the county treasurer, and without any previous order from the Board of Drainage Commissioners, to provide and pay the installments of interest at the time and place as evidenced by the coupons attached to said bonds, and also to pay the annual installments of the principal due on said bonds at the time and place as evidenced by the said bonds, and the said county treasurer shall be guilty of a misdemeanor and subject upon conviction to a fine and imprisonment, in the discretion of the court, if he shall wilfully fail to make prompt payments of the said interest and principal upon said bonds, and shall likewise be liable in a civil action for all damages which may accrue either to the Board of Drainage Commissioners or the holder of said bonds, to either or both of which a right of action is hereby given. Should the total estimated cost of the proposed improvement to be made under this Act be less than an average of 25 cents per

Rolls to be signed by chairman and secretary of Board Drainage Commissioners.

County tax collector to collect assessments.

Lien on lands.

Assessments due first Monday in January.

Sale of lands for nonpayment of assessments.

Tax collector to deliver money collected to county treasurer.

County treasurer to pay installments and interest on bonds.

No bond issue when cost is less than $0.25 per acre.

acre for the total area, then and in that case, bonds shall not be issued, but the assessments shall be collected in cash from the landowners.

State, county and corporations assessed for benefits

Sec. 17. That should the viewers when making their examination and surveys, find that the drainage scheme when carried out will benefit any public highway or any railroad or other public property, then and in that case the viewers shall in their return assess the State, county or corporation an amount which they consider just for the benefits which will be derived through the formation of the drainage district.

Land within outer boundaries which is not benefited can not be taxed but right-of-way across it cannot be denied.

Sec. 18. That if any lands, which will not be affected or benefited by the drainage project shall be located within the outer boundaries of the drainage district as finally established, such fact shall not prevent the formation of the district, and said lands shall not be assessed for any drainage tax; but this shall not prevent the district from acquiring a right-of-way across such lands for constructing a ditch or canal or for any other necessary purpose authorized by law.

Power of eminent domain conferred.

Sec. 19. That if it shall be necessary to acquire a right-of-way or an outlet over and through lands not affected by the drainage, and the same cannot be acquired by purchase, then and in such event the power of eminent domain is hereby conferred, and the same may be condemned. Such owner or owners of the land proposed to be condemned may be made parties defendant in the manner of an ancillary proceeding, and the procedure shall be substantially as provided for the condemnation of rights-of-way for railroads, so far as the same may be applicable, and such damages as may be awarded as compensation shall be paid by the Board of Drainage Commissioners out of the first funds which shall be available from the proceeds of sale of bonds or otherwise.

Damages for condemned land.

Right of assessed landowners to use of ditch.

Sec. 20. That the owner of any land that has been assessed for the cost of the construction of any ditch, drain or water course, as herein provided, shall have the right to use the ditch, drain or water course as an outlet for lateral drains from said land; and if said land is separated from the ditch, drain or water course by the land of another or others, and the owner thereof shall be unable to agree with said other or others as to the terms and conditions on which he may enter their lands and construct said drain or ditch, he may file his ancillary petition in such pending proceeding to the Board of County Commissioners, and the procedure shall be as now provided by law. When the ditch is constructed it shall become a part of the drainage system, and shall be under the control of the Board of Drainage Commissioners and be kept in repair by them as herein provided.

Right of assessed landowner to cross intervening lands to get outlet in main ditch for laterals.

Method of giving notice of intention to issue drainage bonds.

Sec. 21. That the Board of Drainage Commissioners shall give notice for three weeks by publication in some newspaper published in a county in which the district, or some part thereof, is situated, if there be any such newspaper, and also by posting a written or printed notice at the door of the courthouse and at five conspicuous places in the district, reciting that they propose to issue bonds for the payment of the total cost of improvement, giving the amount of bonds to be issued, the rate of interest that they are to bear and the time when payable. Any landowner in the district not wanting to pay interest on the bonds may, within fifteen days after the publication of said notice, pay to the county treasurer the full amount for which his land is liable, to be ascertained from the classification sheet and the certificate of the board showing the total cost of the improvement, and have his lands released from liability to be assessed for the said improvement; but such land shall continue liable for any future assessment for maintenance or for any increased assessment authorized under the law.

Method by which landowner may be relieved of payment of interest on bonds.

Sec. 22. That at the expiration of three weeks after publication of notice of bond issue, the Board of Drainage Commissioners may issue and sell bonds of the drainage district for an amount equal to the total cost of the improvement less such amounts as shall have been paid in cash to the county treasurer, plus an amount sufficient to pay interest on the bond issue for the three years next following the date of issue. These bonds shall bear interest, payable semi-annually, and shall be paid in ten equal installments. The first installment of principal shall mature at the expiration of three years from the date of issue, and one installment for each succeeding year for nine additional years. The commissioners may sell these bonds at not less than par and devote the proceeds to the payment for the work as it progresses and to the payment of the interest on said bonds for the three years next following the date of issue and to the payment of the other expenses of the district provided for in this act. The proceeds from such bonds shall be for the exclusive use of the levee or drainage district specified on their face, and shall be numbered by the Board of Drainage Commissioners and recorded in the drainage record, which record shall set out specifically the lands embraced in the district on which the tax has not been paid in full, which land is to be assessed as hereafter provided. If any installment of principal or interest represented by the said bond shall not be paid at the time and in the manner when the same shall become due and payable, and such default shall continue for a period of six months the holder or holders of such bond or bonds upon which default has been made may have a right of action against said drainage district or the Board of Drainage Commissioners of said district, wherein the Court may issue a writ of mandamus against the said drainage district, its officers, including the tax collector and treasurer, directing the levying of a tax or special assessment as herein provided, and the collection of the same, in such sums as may be necessary to meet any unpaid installments of principal and interest and cost of actions; and such other remedies are hereby vested in the holder or holders of such bond or bonds in default as may be authorized by law; and the right of action is hereby vested in the holder or holders of such bond upon which default has been made, authorizing them to institute suit against any officer on his official bond for failure to perform any duty imposed by the provisions of this Act. The official bonds of the tax collector and county treasurer shall be liable for the faithful performance of the duties herein assigned them. Such bonds may be increased by the Board of County Commissioners at their discretion.

Bond issue authorized.

Interest on bonds and payment of bonds.

Maturity of bonds.

Sale of bonds.

Expenditure of proceeds from bonds.

Right of bondholder to sue for nonpayment of principal or interest.

Suit on official bonds of officers for failure to perform duty.

Sec. 23. That the Board of Drainage Commissioners shall advertise for bids for the construction of the improvement either as a whole or in parts to be let to the lowest responsible bidder or bidders, the board shall have the right to reject any or all bids and readvertise. They shall make such terms for payment with the contractor as they deem proper, and fix the amount of the contractor's bond, which shall be given in favor of the Board of Drainage Commissioners.

Advertisement for bids.

Work let to lowest responsible bidder.

Right to reject all bids.

Contractor to give bond.

Sec. 24. That whenever any improvement constructed under this Act is completed it shall be under the control and supervision of the Board of Drainage Commissioners. It shall be the duty of the said board to keep the levee, ditch, drain or water course in good repair, and for this purpose they may levy an assessment on the lands benefited by the construction of such improvements in the same manner and in the same proportion as the original assessments were made for an amount not to exceed twenty-five per cent. of the original assessment, and the fund that is collected shall be used for repairing and maintaining the ditch, drain or water course in perfect order. Provided, however, that if any repairs are made necessary

Completed work under control of drainage commissioners.

Assessment for maintenance and repairs.

Owner liable for damages caused by his negligence.

Penalty for damaging or obstructing a drainage improvement.

by the act or negligence of the owner of any land through which such improvement is constructed or by the act or negligence of his agent or employee, or if the same is caused by the cattle, hogs or other stock of said owner, employee or agent, then the cost thereof shall be assessed and levied against the lands of said owner alone, to be collected by proper suit instituted by the Drainage Commissioners. It shall be unlawful for any person to injure or damage or obstruct or build any bridge, fence or flood-gate in such a way as to injure or damage any levee, ditch, drain, or water course constructed or improved under the provisions of this Act, and any person causing such injury shall be guilty of a misdemeanor, and upon conviction thereof may be fined in any sum not exceeding twice the damage or injury done or caused.

Salaries of commissioners, engineer, viewers, et. al.

Sec. 25. That the engineers employed under the provisions of this Act shall receive such compensation per diem as shall be agreed upon by the Board of County Commissioners. The viewers, other than the engineer, shall receive three dollars per day; the rodman, axemen, chainmen and other laborers shall receive not to exceed two dollars per day each. The Drainage Commissioners shall have all their actual expenses paid when actually engaged upon the work of the drainage district, but shall receive no per diem. All other fees and costs incurred under the provisions of this Act shall be the same as provided by law for like services in other cases.

Cooperation with U. S. Government.

Sec. 26. That in the event that the United States Government makes provisions for loans to prosecute drainage and reclamation work, or provides for such work to be done in whole or in part under the supervision of its officials, the drainage districts to be created under this Act are empowered to avail themselves of such provisions at any time. That it shall be the duty of the officials of this State to solicit the co-operation of the various bureaus of the United States Government in prosecuting drainage and the reclamation of agricultural lands.

Act to be liberally construed.

"Drainage District Fund."

$2,000 loan available for any drainage district

Must be paid by State Treasurer on warant from State Comptroller.

Loan must be returned after sale of bonds or by petitioners in case district is not organized.

Sec. 27. That the provisions of this Act shall be liberally construed to promote the ditching, draining, leveeing and reclamation of wet and overflowed lands which may be made available for agriculture, and to encourage the starting of such enterprises there is hereby established a fund to be known as the "Drainage District Fund," and the sum of ten thousand dollars is hereby appropriated out of any money that may be in the State Treasury and not otherwise appropriated, to be placed to the credit of that fund, from which loans can be made in sums not to exceed a total of more than two thousand dollars to any one drainage project for the payment of the expenses of the surveys, engineer, viewers, advertising and all other incidental fees and expenses connected with the project up to time of the establishment of the drainage district, and the turning over of the work to the Board of Drainage Commissioners. The money thus loaned shall be paid out by the Treasurer, when there is money to the credit of this fund, on warrant of the State Comptroller upon the receipt of an itemized statement or statements so requesting endorsed by the President and Clerk of the Board of County Commissioners of the county in which the original petition of the particular district was filed. The funds loaned by the State shall be returned to the treasury again through the Board of County Commissioners, who shall collect the amount loaned under a petition filed with them from the petitioners or their bondsmen in case the petition is not allowed, but should the drainage district be established, then from the Board of Drainage Commissioners out of the first proceeds of the sale of the bonds of that district charged with the loan.

No greater sum shall be loaned to one district than is absolutely necessary for its use, in order that the fund may be in circulation and be available for other projects.

Approved April 11, 1912.

A SUGGESTED FORM OF PETITION FOR ESTABLISHING A DRAINAGE DISTRICT.

The Honorable, the Board of County Commissioners of..........
County, State of Maryland.

We, the undersigned, constituting a majority of the resident landowners [or the owners of more than three-fifths of the land in acreage] contained in the proposed drainage district, set forth and fully described below, hereby file with you this, our petition, accompanied by good and sufficient bond, as required and set forth in Section 2, Chapter 656, of the Acts of the General Assembly of Maryland, 1912, for such action thereon as is provided in the said Chapter 656, Acts of 1912.

The proposed drainage district is to include all of that territory described as follows:

(Insert a description of the general location of the district and a specific description of the beginning, route and terminus of the drain.) ....

We respectfully submit that the locating and establishing of such drain will be conducive to the public health, convenience and welfare.

Wherefore, your petitioners pray that you issue a summons to be served on all of the landowners who have not joined in this petition, and whose lands are included in the proposed drainage district, and that thereupon you proceed to appoint a Board of Viewers to examine the lands described in this petition and make a preliminary report thereon, as provided for in the law hereinbefore mentioned.

Dated this............day of.................A. D., 19

(Follow with list of signers.)

....

....

THE MARYLAND AGRICULTURAL
EXPERIMENT STATION

BULLETIN No. 187. NOVEMBER, 1914.

PROFITABLE AND UNPROFITABLE COWS.

Cow Testing Associations in Maryland.

G. E. Wolcott.

Review of Cow Testing Work in Maryland.

The tables found in the following pages are compiled from the records of three cow testing associations in the State of Maryland. More than 1,100 cows are included in the three associations. The First Maryland Cow Testing Association, located in Baltimore County, has been in operation for nearly four years. The records published cover a period of three years. The First Harford County Dairy Improvement Association was organized in the fall of 1911; and records are compiled for the first two years. The Rising Sun Dairy Improvement Association furnishes complete records for two years.

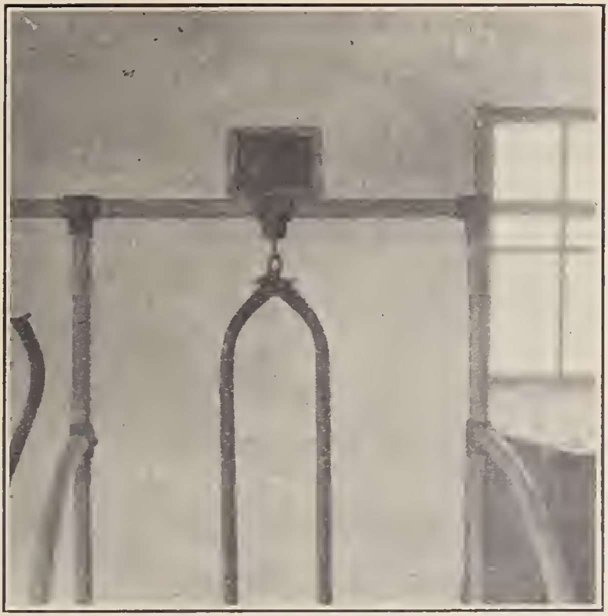
Cow Testing associations are local organizations including not more than 26 dairymen. The association employes a tester, who visits the farm of each member one day during the month. The tester arrives at the farm in the afternoon. While the evening milking is being done, he weighs the milk produced by each cow. At the same time he takes a sample of each cow's milk, which is placed in a small bottle. The feed consumed by each cow is recorded in the stable book beside the weight of her milk. The next morning the weight of each cow's milk is recorded in its proper place. A sample of her milk is also taken and added to the sample that was saved the evening before; thus making a composite sample, which is later tested for percentage of butterfat according to the Babcock Method. The total weight of the two milkings constitute a day's yield, and is used as a basis for estimating the production for the month. The dairyman knows the market price of his feeds, and the tester has the amount of each feed consumed by every cow in the herd, recorded in the stable book; so it is easy to calculate the cost of feed for the month. After the morning's milking, the tester makes the determinations for percentage of fat in each cow's milk. He then makes the calculations for the month which include the amount of milk and fat produced, the value of the product, the cost of feed, the profit or loss, the returns for $1. expended for feed, the feed cost of producing 100 pounds of milk, and the feed cost of producing 1 pound of fat. This record is made for each cow in the herd, a copy of which is left with the dairyman. Before leaving the farm, the tester makes a summary which gives the total production of the herd for the month. At the end of twelve months the yearly summary is compiled, which gives the record of each cow in the herd for the year just ended.

Object and Advantages of Cow Testing Associations.

The object of the cow testing association is to make the herd return a greater profit. The first step toward an increased production and a larger profit, is to learn how much milk and fat each cow in the herd produces in one year, and how much feed was required to make that production. When this is known, the cows that do not show a fair profit over the cost of feed can be discarded. By disposing of the cows that show an actual loss or that merely pay for their feed, the average production per cow will be increased, and the net profit of the herd will be larger with a lower consumption of feed.

Again, production can be increased by a system of individual feeding. When the production of each cow in the herd is known from month to month, the large producers can be fed according to their yields; likewise those that make a lower production. If no records are kept, individual feeding is impracticable; and in many dairies all cows are fed alike. When no records are kept; and all cows are fed about the same amount of feed, the dairyman loses in two ways. First, the cows that are capable of making a large production are underfed. If they were given their full requirement, the production would be more economical. Second, the low producers are fed more than they require for their production, consequently, the extra feed makes no return. In one case the cow is underfed and in the other, overfed.

In order to follow a system of individual feeding, many dairymen throughout the State have fastened a small school slate, which costs 2½ cents, to the stanchion or manger of each cow. Each animal is fed all the roughage she will eat without waste. The weights of milk and fat produced the previous month are recorded on the slate; also, the amount of grain being fed for the current month. The allowance of grain is changed to meet the requirements of the individual; and by noting whether an increased allowance of grain is accompanied by an increased production, the individual of the herd can be fed according to her ability to make returns. Such a system of feeding is sure to be followed by an increased yield and a more economical production.



Stanchion, with slate attached, for individual feeding.

Another factor, which has considerable influence on the economy of production, is the feeding of a balanced ration. The cow requires for the maintenance of her body and the production of milk, proteins, carbohydrates and fats in certain proportions. A balanced ration is a mixture of feeds which supply these nutrients in their proper proportions. By careful selection and mixing, a ration may be much cheaper and produce a large flow of milk than one selected without regard to having the nutrients in proper proportion, or balanced. One of the functions of the cow testing association is to assist the farmer in making the proper combination of feeds.

Another advantage which is derived from cow testing associations, and one which will increase the average production of the herd, is the selection of heifer calves which are the offspring of the highest producing cows. If these calves have been sired by a pure bred bull of high producing ancestry, the herd will be in a few generations uniform in type and color, and of high average production.

The tester seems to stimulate interest among the milkers and boys on the farm. When the high and low producers are indentified by their records, there is bound to be some effort made to increase still further the yields of the high producers; and to keep the moderate producers on a profitable basis by more careful feeding.

The First Maryland Cow Testing Association.

Table 1.

Average Production Per Cow for the First, Second and Third Year.

Year	Lbs. milk	Lbs. fat	Per cent of Fat	Price per 100 lbs. milk	Cost of feed	Profit above cost of Feed	Returns for $1 expended for feed	Feed cost per 100 lbs. milk	Feed cost per lbs. fat
1st	4456	202	4.53	$1.85	$45.67	$37.14	$1.81	$1.02	$.22
2nd	5323	223	4.18	2.04	52.56	56 24	2.07	.98	.23
3rd	5116	229	4.47	2.23	46.99	67.30	2.43	.91	.20

It will be noted by referring to the above table that the average production per cow the second year was increased 867 lbs. of milk, which increase amounted to 21 lbs. of butter fat. The cost of feed consumed the second year was greater by $6.89, while the profit above the cost of feed was increased $19.10. The price of milk was somewhat higher the second year, which adds to the profit; but the feed cost of 100 lbs. of milk the second year was less than the first.

The third year shows the average cow producing slightly less milk than the second year, but more fat. The cost of feed was $5.57 less than the second year, and the profit over the cost of feed was increased $11.06. The increased price of milk accounts for a part of the increased profit the third year, although the feed cost of 100 lbs. of milk the third year was 7 cents less than the second year.

The First Maryland Cow Testing Association.

Table 2.

Association Summary, Sept. 1912 to Sept. 1913, (Third Year).

Herd letter	Lbs. Milk	Lbs. Fat	Value	Cost of feed	Profit above cost of feed	Returns for $1 expended for feed	Feed cost per 100 lbs milk	Feed cost per lb. fat
A	6779	277	$194.81	$67.58	$127 23	$2 88	$.99	$.24
B	4745	220	95.23	42.29	52.94	2.25	.89	.19
C	4042	172	75.03	34.47	40.56	2.17	.85	.20
D	5223	238	96.57	40.53	56.04	2.38	.77	.17
E	4595	226	86.01	37.38	48.63	2.30	.81	.17
F	4138	192	182.04	38.95	43.09	2.10	.94	.20
G	7723	385	166.86	62.54	104.32	2.66	.80	.16
H	4005	198	83.62	48.40	35.22	1.72	1.20	.23
I	4092	198	77.41	43.06	34.35	1.79	1.05	.21

A study of Table 2 will show that there is a wide variation in the average production of the various herds in the association. The average cow in herd A. produced 277 lbs of fat, in herd G., 385 lbs of fat, while the average production in herds C., F., H., and I. was 172, 192, 198, and 198 respectively. Herds A. and G. are composed largely of pure breds; herds C., F., H., and I. are grades; herds B., D., and E. producing 220, 228, and 226 lbs. of fat respectively are also grades.

THE FIRST HARFORD COUNTY DAIRY IMPROVEMENT ASSOCIATION.

Records of the First Harford County Dairy Improvement Association are available for the first and second years.

Table 3.

Average Production Per Cow; First and Second Years Compared.

Year	Number of cows	Lbs. milk	Lbs. fat	Per cent of fat	Price per 100 lbs. milk	Value of product	Cost of feed	Profit over cost of feed	Returns for $1 expended for feed
1st	421.4	4786	234	4.9	$2.06	$99.05	$42.19	$54.86	$2.35
2nd	440.5	5248	264	5.0	2.15	112.18	43.80	68.38	2 56
Gain		462	30		0.09	$13.13	$1.61	$13.52	$0.21

An examination of the above table (Table 3), will show that the average cow produced 4786 lbs of milk the first year, which contained 234 lbs. of fat. The second year this production was exceeded by 462 lbs. of milk; the increase amounted 30 lbs. of fat. The average percentage of fat (5.0) shows a preponderance of Channel Island breeds in this association. The average cow consumed $42.19 worth of feed the first year; the second year the feed consumed amounted to $43.80, which represents an increase of $1.61 in the cost of feed consumed. The profit above the cost of feed the second year was $13.52 greater than the first year.

The average price of milk the second year was higher than the first, but the larger part of the increased profit was due to a higher and more economical production. Every dollar expended for feed the first year, returned $2.35; the same value in feed the second year returned $2.56—a gain of 21 cents.

Table 4.

FIRST HARFORD COUNTY DAIRY IMPROVEMENT ASSOCIATION.

Herd Averages for the Second Year. (1912-1913).

Herd letter	Aver. No. of cows	Lbs. milk	Lbs. fat	Per cent of fat	Cost of feed	Profit over cost of feed	Returns for $1. expended for feed
A	34.1	6463	317	4.9	$44.96	$86.42	$2.92
B	22.8	4876	245	5.3	36.21	62.36	2.72
C	29.3	5643	277	4.9	44.80	77.19	2.72
D	20.1	4383	245	5.6	43.45	58.91	2.35
E	20.3	5239	249	4.7	46.49	62.29	2.34
F	19.8	6385	263	4.1	38.59	69.89	2.81
G	18.5	3612	171	4.7	33.92	23.81	1.70
H	20.5	5880	263	4.5	45.94	74.77	2.62
	15.8	6082	294	4.9	46.75	67.67	2.44
J	13.0	5911	265	4.5	39.10	75.43	2.92
K	13.8	5387	267	4.9	52.45	136.29	3.59
L	12.8	6079	320	5.3	53.87	77.11	2.43
M	13.0	7640	355	4.6	44.92	98.05	3.18
N	17.7	5225	235	4.5	51.24	49.32	1.96
O	14.7	5602	227	4.1	37.74	66.32	2.75
R	10.6	5252	254	4.8	44.86	59.22	2.32
T	12.6	5911	258	4.3	39.43	72.92	2.84
U	22.1	4852	224	4.6	31.57	58.20	2.84
V	50.0	5943	299	5.3	52.04	83.30	2.60
W	10.6	4925	254	5.2	42.50	59.24	2.39
X	15.0	3990	203	5.1	38.82	37.22	1.95
Y	9.7	6306	292	4.9	45.29	52.52	2.16
Z	19.8	4890	236	4.8	44.42	36.23	1.81
Aver. per cow		5248	264	5.0	$43.80	$68.38	$2.56

By looking over Table 4 it will be seen that, (except in a few cases), the average of the herds is uniformly high. Herd G. is the only one that averages less than 200 lbs. of fat. Herd M. shows an average production of 355 lbs. of fat. The feed consumed cost $44.92; the profit above the cost of feed amounted to $98.05. For every dollar expended for feed this herd returned $3.18. Herd M. is composed of grade cows, and their records show careful selection and proper feeding. The average cow in the low producing herd (G.) consumed $33.92 worth of feed for which she made a return of 171 lbs. of butter fat; whereas the average cow in herd M. consumed $44.92 in feed, returning 355 lbs. of fat—more than double the average yield in herd G.

Table 5.

First Harford County Dairy Improvement Association.

Records of the Ten Highest and the Ten Lowest Producing Cows for Year, 1912-13.

Ten highest producing cows.						Ten lowest producing cows.					
Herd letter	Lbs. milk	Lbs. fat	Cost of feed	Profit over cost of feed	Returns for $1 expended for feed	Herd letter	Lbs. milk	Lbs. fat	Cost of feed	Profit over cost of feed	Returns for $1 expended for feed
M	9119	501	$42 38	$122.74	$3.89	B	1162	66	$26 53	$3.16	$1.11
A	10011	492	51 54	154.95	4.00	C	2592	123	39.29	15.82	1 40
C	8684	445	45.68	143.67	4.14	B	3650	151	34.50	23.98	1 69
V	8551	419	55.27	138.06	3.49	D	2420	152	37.92	26.85	1.70
M	8783	416	46.70	117.75	3.52	R	3785	153	38.61	23.72	1.61
D	6779	416	50.01	124.51	3.48	N	3810	156	43.74	24.94	1.57
F	10108	410	43.69	113.64	3.60	F	3546	158	36.65	29.82	1.81
Y	7400	403	36.73	100.98	3.72	N	3718	161	45.21	17.39	1.38
A	7828	399	47.75	116.62	3.44	B	3694	175	37 35	35.16	1 94
M	8312	396	48.42	111.67	3.30	H	4250	180	42.74	40.25	1.94
Aver	8557	429	$46.81	$124.45	$3.65	Aver.	3262	147	$38.25	$24.10	$1.63

Although the Harford County cows have demonstrated their ability to make large productions, Table 5 shows that a few low producers were being fed the second year. The ten lowest producing cows averaged a little more than one-third the amount of fat produced by the average of the ten highest producing cows. The average of the ten low producing cows consumed $38.25 in feed, returning a profit of $24.10 above the cost of feed. The ten high producers consumed on the average $46.81 in feed, and returned a profit above the cost of feed amounting to $124.45.

The cow which made the highest production in the association yielded 9119 lbs. of milk, containing 501 lbs. of fat. For every dollar she consumed in feed, a return of $3.89 was made, which shows that a large producer is also an economical producer. The low producing cow in herd B. returned only $1.11 for a dollar consumed in feed.

Table 6.

FIRST HARFORD COUNTY DAIRY IMPROVEMENT ASSOCIATION, 1912-13,

Highest producing cow, and lowest producing cow in each herd.

	Highest producing cow.					Lowest producing cow.				
Herd letter	Lbs. milk	Lbs. fat	Cost of feed	Profit over cost of feed	Returns for $1. expended for feed	Lbs. milk	Lbs. fat	Cost of feed	Profit over cost of feed	Returns for $1. expended for feed
A	10011	492	$51.54	$154.95	$4.00	4138	231	$39.02	$58.88	$2.50
B	6267	347	42.21	101.80	3.41	1162	66	26.53	3 16	1.11
C	8684	445	45 68	143.67	4.14	4250	180	42.74	40.25	1.94
D	6779	416	50.01	124.51	3.48	2420	152	37.92	26.85	1.70
E	6487	333	50.87	94.54	2.85	4068	209	48.11	41.76	1.86
F	10108	410	43.69	113.64	3.60	3546	158	36.65	29.82	1.81
H	7122	387	47.73	133.03	3.78	2592	123	39.29	15.82	1.40
I	6642	352	48.92	75.61	2.54	5851	265	41.97	68.23	2.62
J	6654	318	37.67	100.24	3.66	4844	223	36 41	58.85	2.61
M	9119	501	42.38	122.74	3.89	5838	252	38.29	66.01	2.72
N	6946	332	56.29	92.17	2.63	3810	156	43.74	14.94	1.34
O	6174	331	36.35	74.43	3.04	4661	188	36.04	52 47	2.45
R	6990	371	50.15	105.02	3.09	3785	153	38.61	23.72	1.61
T	9952	333	48.01	138.80	3.89	5526	210	41.87	70.60	2.68
V	8551	419	55.27	138.06	3.49	5420	202	47.76	43.02	1.90
W	6124	321	48.07	80.21	2.66	3544	182	37.86	35.16	1.92
Y	7400	403	36.73	100.98	3.74	5515	227	39.10	40.26	2.02
K	6683	318	51.03	188.13	4.68	4700	228	52.64	112.21	3.13
Aver.	7945	359	$46.81	$115.69	$3.47	4203	189	$40.25	$44.55	$2.10

A study of Table 6 will show that in most herds there is a wide variation between the highest and lowest producing cows. The average production of the eighteen cows—considering the "best" in each herd—amounted to 7945 lbs. of milk, with a fat content of 359 lbs., while the average of the eighteen low producers in the same herds amounted to but 4203 lbs. of milk, 189 lbs. of fat. Herds A, M, and V. show very large productions for the "best" cows and fair productions for the "poorest" cows. Herds I. J. Y. and K. show more uniformity of production. The "best" cow in each of these herds shows a rather high production; the "poorest" cows in the same herds show a production much higher than the average of the "poorest" cows in each of the eighteen herds. In herd I. the low producer made a larger yield than the average of the association.

Cow in Herd M. Production for one year—milk, 9,919 lbs.; fat, 501 lbs.

This pure bred calf is supposed to increase the average in Herd I.

Cow in Herd A. Production for one year—milk, 10,011 lbs.; fat, 492 lbs.

Cow in Herd I. Production for one year—milk, 6,642 lbs.; fat, 352 lbs.

Table 7.

First Harford County Dairy Improvement Association.

Average production for the first year compared with the average production for the second year in each herd.

Herd letter	Year	Aver. No. of cows	Lbs. milk	Lbs. fat	Cost of feed	Profit over cost of feed	Returns for $1. expended for feed
A	1st.	32 0	5357	259	$42.12	$80 58	$2.91
	2nd.	34.1	6463	317	44.96	86.42	2.92
B	1st.	33.1	4685	256	37 21	49 81	2.33
	2nd.	27.8	4876	245	36.21	62.36	2.72
C	1st.	26.7	5051	252	41.06	56.09	2.36
	2nd.	29.3	5648	277	44.80	77.19	2.72
D	1st.	25 3	4157	228	35 34	54.45	2.54
	2nd.	20.1	4383	245	43.45	58.91	2.35
E	1st.	22.1	4377	213	42.02	54.29	2.29
	2nd.	20.3	5239	249	41.49	62 29	2.34
F	1st.	20.9	5143	235	40.93	55.72	2.36
	2nd.	19.8	6385	263	38.59	69.89	2.81
H	1st.	23.9	4491	210	35 69	51.60	2.44
	2nd.	20.5	5880	263	45 94	74.77	2.62
I	1st.	17.8	5098	249	39 25	57.52	2.47
	2nd.	15 8	6082	294	46.75	67.67	2.44
J	1st.	14.0	4982	236	37 03	64.42	2.73
	2nd.	13.0	5911	265	39 10	75 43	2.92
M	1st.	11 6	5995	273	44 85	67.73	2.51
	2nd.	13.0	7640	355	44.92	98 05	3.18
N	1st.	14.3	5142	249	46 03	54.57	2.18
	2nd.	17.7	5225	235	51.24	49.32	1.96
O	1st.	13.9	5097	226	47.44	49.44	2.04
	2nd.	14.7	5602	227	37.74	66 32	2 75
R	1st.	11.5	4402	209	30.85	54.88	2.77
	2nd.	10.6	5252	254	44.86	59.22	2.32
T	1st.	12 0	5223	244	43.30	58 27	2.34
	2nd.	12.6	5911	258	39.43	72.92	2.84
U	1st.	20.2	4235	204	45 11	38.05	1.84
	2nd.	22.1	4852	224	31.57	58.20	2.84
V	1st.	31.9	5517	296	55.06	81.51	2.48
	2nd.	50.0	5944	299	52.04	83 30	2.60

It will be noted, by an examination of Table 7, that, with the exception of two herds, the average production of butter fat was increased. Herd A. increased the average yield of fat from 250 lbs. to 317 lbs. Two cows were sold from this herd the first year, and five the second year. Herd I. increased the average yield of milk nearly 1,000 lbs., which increase amounted to 45 lbs. of fat. During the two years only one cow was sold.

Herd M. Avergae production for one year—milk, 7,640 lbs. ; fat, 355 lbs.

Lady Letty's Eminent (82309), whose offspring is "making good" in Harford County. Five daughters of his sire (Eminent 2nd) sold for $10,000 at Cooper's sale.

During the second year the cows were grouped according to fat production with the following results:

1 cow produced 501 lbs. of fat.
1 cow produced 492 lbs. of fat.
1 cow produced 445 lbs. of fat.
5 cows produced between 400 and 425 lbs. of fat.
8 cows produced between 375 and 400 lbs. of fat.
18 cows produced between 350 and 375 lbs. of fat.
29 cows produced between 325 and 350 lbs. of fat.
37 cows produced between 300 and 325 lbs. of fat.
58 cows produced between 275 and 300 lbs. of fat.
49 cows produced between 250 and 275 lbs. of fat.
48 cows produced between 225 and 250 lbs. of fat.
19 cows produced between 200 and 225 lbs. of fat.
19 cows produced between 175 and 200 lbs. of fat.
5 cows produced between 150 and 175 lbs. of fat.
1 cow produced less than 150 lbs. of fat.

The Rising Sun Dairy Improvement Association.

The Rising Sun Dairy Improvement Association was organized a few months after the association in Harford County began its first year of record work; and records for the first two years are now available.

Table 8.

Rising Sun Dairy Improvement Association.

Average production per cow; first and second years compared.

Year	Number of cows	Lbs. milk	Lbs. fat	Per cent of fat	Price per 100 lbs. milk	Value of product	Cost of feed	Profit above cost of feed	Returns for $1. expended for feed
1st	327.2	4584	205	4.4	$1.82	$83.48	$38.18	$45.30	$2.18
2nd	285.4	5592	242	4.3	1 78	99.73	37.57	62.16	2.65
Gain		1008	37		$0.04 Less	$16.25	$.61 Less	$16.86	$.47

The above table (table 8) shows that the average cow in this association made a substantial increase in production the second year. Her milk yield was increased 1008 lbs., containing 37 lbs. of fat. The average price paid for milk was 4 cents less than the previous year, yet the value of the product amounted to $16.86 more. The cost of feed consumed by the average cow was 61 cents less than the first year. The returns for one dollar expended for feed was 47 cents greater the second year.

Table 9.

RISING SUN DAIRY IMPROVEMENT ASSOCIATION.

Herd averages for the second year (1913-1914).

Herd letter	Aver No. of cows	Lbs. milk	Lbs. fat	Per cent of fat	Cost of feed	Profit above cost of feed	Returns for $1. expended for feed	Feed unitsconsumed	Lbs. fat per 100 feed units
A	26.7	4413	197	4.5	$42.37	$89.38	$3.10	4560	4.32
B	14.6	7165	283	4 0	31.72	77.06	3.42	4750	5.97
C	27.2	6081	231	3.8	41.04	54.18	2.32	5074	4.55
D	12.3	6093	290	4.8	41.41	68.15	2.64	4958	5.86
G	14.6	4683	242	5.2	37.69	50.49	2.34	4746	5.10
J	18.0	7143	300	4.2	47.91	69.76	2.45	5233	5 74
K	17 2	5365	219	4.1	36.47	49.68	2.33	4331	5.05
L	15.7	4927	229	4.7	38.02	46.75	2.22	4742	4.84
N	9.3	5884	250	4.3	27.33	66.12	3.25	4525	5.53
R	13 6	4755	237	5.0	33.24	57.40	2.72	4188	5.68
U	12 1	4685	231	4 9	38.66	45.79	2.18	4225	5.48
V	5.1	4136	186	4.5	20 08	51.53	3.56	3179	5.87
F	19.8	6223	248	4.0	42.86	54.31	2.26	5682	4.33
H	13.1	5720	249	4.4	45.82	77.19	2.68	4284	5.82
I	6.9	5008	214	4.3	30.60	49.36	2.61	4750	4.50
M	9.9	7679	279	3.6	56.32	83.99	2.49	5161	5.42
O	6 2	4102	200	4.9	33.04	38.91	2.17	4028	4 97
P	13.5	4794	221	4.6	40 99	44.30	2.08	4537	4.87
Q	8.0	7542	352	4.6	38.11	90.45	3.37	5222	6.74
S	12.4	3974	179	4.5	14.00	48.53	4.46	3753	4.78
E	7.4	6294	264	4.2	13.19	78.76	6.97	4005	6.60
Aver. per cow		5592	242	4.3	$37.57	$62.16	$2.65	4668	5.19

During the second year, the average production of butter fat in the different herds varied—as Table 9 demonstrates—from 352 lbs. to 179 lbs. in herds Q. and S. respectively. Two herds averaged more than 300 lbs. of fat; three herds averaged less than 200 lbs. of fat.

A new system for comparing the economy of production of different cows was adopted at the beginning of the second year. The practice of comparing the economy of production by the returns for one dollar consumed in feed was not altogether satisfactory or fair, because one dairyman might purchase his concentrates in larger quantities than another, thereby paying less per ton for the same feed. To obviate this inconsistency, and make all comparisons on the same basis the feed consumed is expressed in feed units.

A feed unit in the United States is equal to one pound of ground oats. Other feeds are given numerical values which express their relative values for milk production as compared with oats. For example, .76 of a pound of cottonseed meal is equal to one pound of ground oats; 1.26 pounds of wheat bran is equal to one pound of ground oats, or .76 of a pound of cottonseed meal. Two pounds of alfalfa hay has a value, for milk production equivalent to one pound of ground oats. It requires 6.62 pounds of corn silage to equal 2 pounds of alfalfa hay or 1.26 pounds of bran.

It will be noted by referring to Table 9 that the average cow in herd A. consumed 4560 feed units, which means that the feed she consumed—both roughage and grain—was equal in feeding value to 4560 pounds of ground oats. For every 100 feed units consumed, she made a return of 4.32 lbs. of fat. Herd Q. returned 6.74 lbs. of fat for 100 feed units consumed, while the average cow in the association returned 5.19 lbs. of fat for the same number of units.

Table 10.

RISING SUN DAIRY IMPROVEMENT ASSOCIATION.

Records of the ten highest and ten lowest producing cows for the year 1913-14.

Records for the ten highest producing cows.

Herd letter.	Lbs. milk	Lbs. fat	Cost of feed	Profit over cost of feed.	Feed units consumed	Lbs. fat produced per 100 feed units
B	8424	416	$33.89	$98.55	4995	8.33
J	9820	406	48.62	115.72	5612	7.25
B	8643	396	30.09	102.70	4839	8.19
B	12468	386	32.83	146.71	4995	7.74
F	8503	379	50.57	87.37	6522	5.81
J	7825	368	48.62	85.00	5206	7.07
M	8362	362	52.64	97.55	5171	7.00
J	7810	351	46.82	84.87	5307	6.62
D	7543	346	42.47	89.82	5214	6.64
C	9531	344	45.93	107.43	5405	6.36
Aver. per cow	8892	375	$43.25	$101.54	5326	7.05

Records for the ten lowest producing cows.

Herd letter	Lbs. milk	Lbs. fat	Cost of feed	Profit over cost of feed	Feed units consumed	Lbs. fat produced per 100 feed units
A	2790	112	$38.07	$46.49	4237	2.66
K	3099	124	33.35	11.30	4135	3.01
K	3660	131	37.81	12.31	4535	2.89
A	3012	135	40.39	44.75	4500	3.00
C	4257	137	45.98	19.23	5285	2.59
A	2649	138	42.44	42.15	4510	3.06
A	3480	142	40.39	54.71	4530	3.13
L	3339	151	41.88	17.03	4760	3.18
L	3453	156	41.88	14.60	4460	3.50
F	4700	159	40.32	27.11	5214	3.05
Aver. per cow	3448	138	$40.25	$28.96	4616	3.07

By comparing the ten "best" cows in the association (Table 10) with the ten "poorest," it will be seen that the highest producers averaged 8892 lbs. of milk which contained 375 lbs. of fat. For every 100 feed units consumed these cows made a return of 7.05 lbs. of fat. The ten low producers averaged 3442 lbs. of milk, 138 lbs. of fat; and made a return of 3.07 lbs. of fat for 100 feed units consumed. The returns in fat for 100 feed units consumed was greater by 3.98 lbs. in the case of the high producers.

In comparing the economy of production between the highest producing cow, it will be noted that the former yielded 416 lbs. of butter fat, consumed 4995 feed units, and returned 8.33 lbs. of fat for 100 feed units; the latter yielded 112 lbs. of fat, consumed 4237 feed units, and returned 2.66 lbs. of fat for 100 feed units. The high producer returned 5.67 lbs. more fat for 100 feed units than the low producer.

Table 11.

Rising Sun Dairy Improvement Association.

Records of the highest and lowest producing cows in each herd, 1913-14.

	Highest producing cow				Lowest producing cow			
Herd letter	Lbs. milk	Lbs. fat	Feed units consumed	Lbs. fat produced per 100 feed units	Lbs. milk	Lbs. fat	Feed units consumed	Lbs. fat produced per 100 feed units
A	8338	295	4796	6.15	2790	112	4237	2.65
B	8424	416	4495	8.83	4866	190	4501	4.23
C	9531	344	5405	6.36	4257	137	5285	2.59
D	7543	346	5214	6.64	5114	230	4867	4.73
G	6324	312	4792	6.51	4053	198	4870	4.08
J	9820	406	5612	7.25	5894	239	5266	4.55
K	7818	294	4847	6.08	3099	124	4135	3.01
L	5736	270	4860	5.56	3339	151	4760	3 18
N	6804	328	4706	6.98	4398	214	4646	4.62
U	5907	294	4398	6.69	3420	172	4184	4.13
V	4209	204	3171	6.45	4453	180	3201	5.62
R	7401	335	4767	7 02	2859	167	3923	4.25
M	8362	362	5171	7.00	7152	247	5165	4 79
F	8503	379	6522	5.81	4700	159	5214	3.05
P	5442	287	4502	6.37	4779	170	4.56	4.09
Aver. per cow	7341	325	4917	6.60	4344	179	4560	3.92

Table 11 shows that 15 high producing cows—considering the highest producer in each herd—averaged 7341 lbs. of milk, 325 lbs. of fat. The average yield of the lowest producing cows in the same herds was 4344 lbs. of milk, 179 lbs. of fat. The average consumption

Cow in Rising Sun Dairy Improvement Association. Production for one year—milk, 9,820 lbs.; fat, 406 lbs.

Cow in Rising Sun Dairy Improvement Association. Production for one year—milk, 8,068 lbs.; fat, 301 lbs.

of feed in the case of the high producers was 4917 feed units, while the low producers consumed 8 per cent. less or 4560 feed units. The low producers consumed 8 per cent. less feed than the high producers and returned 45 per cent. less milk, which demonstrates the economy of the high producers.

Table 12.

RISING SUN DAIRY IMPROVEMENT ASSOCIATION.

Comparison of herd averages for first and second years.

Herd letter	Year	Number of cows	Lbs. milk	Lbs. fat	Cost of feed	Profit above cost of feed	Returns for $1. expended for feed
A	1st.	26.0	4078	175.7	$48.39	$79.58	$2.64
	2nd.	26.7	4413	197.1	42.37	89.38	3.10
B	1st.	16.4	5851	251.8	38.38	55.68	2.38
	2nd.	14 6	7165	283.6	31.72	77.06	3.42
C	1st.	24.0	5636	213.4	36.17	46.68	2.29
	2nd.	27.2	6031	231.1	41.04	54.18	2.32
D	1st.	13.0	5604	295.3	39.48	62 94	2.59
	2nd.	12.3	6093	290.7	41.41	68.15	2.64
G	1st.	17.0	4136	206.6	36.50	42.34	2.16
	2nd.	14.6	4683	242.2	37.69	51 49	2.34
J	1st.	15.6	5052	214.2	42.71	41.85	1.98
	2nd.	18.0	7143	300.7	47 91	69.76	2.45
K	1st.	16.2	4464	182 7	33.26	39.92	2.20
	2nd.	17.2	5365	219.1	36.47	49.68	2.33
L	1st.	16.4	4530	212.9	42.95	34.46	1.80
	2nd.	15.7	4927	229.7	38.02	46.75	2.22
N	1st.	16.2	4322	173.5	34.65	33.41	1.96
	2nd.	9.3	5884	250.4	29.33	66.12	3.25
R	1st.	14.4	4221	197.1	48.09	37.36	1.77
	2nd.	13.6	4755	237.9	33 24	57.40	2.72
U	1st.	13.1	3159	151.6	33.53	23.29	1.69
	2nd.	12 1	4685	231.8	38.66	45.79	2.18
V	1st.	5 4	3675	166.9	28.20	34.72	2.23
	2nd.	5.1	4136	186.8	20.08	51.53	3.56

Table 12 shows that there was an increase in milk production and the returns for one dollar in feed in every herd. Herd D. is the only herd to show a lower yield of butter fat; the yield being 4.6 less in a herd that was producing close to 300 lbs. of fat per year. Herd J. shows a remarkable increase in both milk and fat. The feed consumed averaged $5.20 more; and the profit above the cost of feed exceeded that of the first year by $27.91. The average in herd J. returned 47 cents more for a dollar in feed the second year than the first. It was not by shifting the individuals of the herd that this increase was made; the herd was not materially different the second year, but the system of feeding and management was changed, thus bringing about the improvement in production.

Herd J. Average production for one year—milk, 7,143 lbs.; fat, 300 lbs.

SUMMARY.

1. The first year's records show that there was a wide variation in production between the individuals of the herd; some made large yields, while others were kept at a loss or barely paid for their feed.
2. The records for the second year prove that by disposing of low producing cows, the average production of the herd was increased.
3. In a number of herds increased production was brought about by feeding the individuals of the herd according to their ability to produce milk and fat. This was the case in herds where no abnormally low producers were found.
4. The high producing cows were the most profitable. It requires a certain amount of feed to maintain a cow; after this allowance is supplied, the more feed she consumes, the cheaper the production.
5. When the production of the individuals in the herd was known, the members of the associations were able to save the heifer calves from the best cows.
6. One year's record work is not sufficient. When the herd has reached a high average of production constant selection is necessary to maintain this average.
7. The association in Harford County shows a higher average production of butter fat than the other associations. This is due to

the fact that several large herds of pure bred cattle have been kept in the County for many years, and the pure bred bulls from these herds have been used freely.

8. The feed records show that legume hays are not being used generally. The association in Harford County fed only two tons of legume hay the first year; and four tons the second year. The Rising Sun Association fed but a little over one ton of legume hay during the two years.

THE MARYLAND AGRICULTURAL EXPERIMENT STATION

BULLETIN 188 DECEMBER, 1914

TYPES AND VARIETIES OF MARYLAND TOBACCO

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Results of Investigations Conducted by the Maryland Agricultural Experiment Station in Cooperation with the United States Department of Agriculture.

Introductory.

In Maryland, as in Virginia, commercial tobacco culture dates back to the earliest history of the Colonies, and from the outset tobacco was practically the only agricultural commodity which could be advantageously exchanged for the many necessities imported from Europe. The tobacco industry grew so rapidly that it soon became an important factor in the colonial policy of England. Under this policy tobacco could not be exported to any save the mother country. Maryland, however, having a palatinate form of government, was exempted from this restriction. As a result, tobacco from Virginia and the other Colonies moved to England while that from Maryland went largely to Holland and France. Thus, the market for Maryland tobacco early established in Holland and France has persisted and these two countries still take the greater portion of the crop.

At an early period the culture of tobacco extended over eastern and southern Maryland and the counties on the eastern shore of the Chesapeake became large producers. At the present time, however, tobacco culture is confined almost entirely to the five counties of southern Maryland lying between the Potomac river and Chesapeake Bay and the so-called Upper-County or district of northern Montgomery and adjoining areas of Howard, Carroll and Ferederick counties. The southern Maryland district produces nearly 95% of the total crop of the state and the matters discussed in the present bulletin are applicable more particularly to this section.

The quantity of tobacco produced in the state has fluctuated widely from time to time. The crop of 1861 reached the high figure of 51,000 hogshead, or about 36,000,000 pounds. In late years the annual production has averaged about 18,000,000 pounds. A decrease in production has been brought about largely as a result of the increased cost of production of tobacco and higher price levels for other crops to which farmers have turned their attention. More recently Maryland tobacco, in common with most other types of the export and manufacturing tobaccos, has commanded somewhat higher prices. It appears that there is a rather steady demand at profitable prices for the quantity of Maryland tobacco now being produced (about 25,000 hogsheads annually) provided the tobacco is grown and handled under such conditions as will insure good quality and reasonably good yields.

Characteristics of Maryland Types of Tobacco.

Maryland tobacco as a whole owes its popularity to its good burning qualities, fineness of texture and light body and its color. It is deficient in so-called oil or gum and is of a decidedly dry or chaffy character. Because of its desirable color and burning qualities Maryland tobacco is extensively used in European countries for mixing with other less attractive but more aromatic tobaccos to improve their appearance and combustibility. It is specially adapted to the manufacture of pipe smoking tobaccos and cigarettes. It is not sufficiently aromatic and does not possess sufficient life and elasticity for the manufacture of cigars, although it has been used to a limited extent for blending in the manufacture of the cheaper cigars.

The Maryland types resemble in many respects Connecticut Seedleaf and Kentucky Burley. They differ mainly from Connecticut Seedleaf in being deficient in oil or gum and elasticity and showing a tendency toward redder colors. In any case the Maryland leaf does not come into competition with the much higher priced Connecticut Seedleaf. Maryland tobacco differs from White Burley mainly in that it has less capactiy for absorbing the sauces employed in the manu--facture of plug chewing tobacco for which the Burley is chiefly used. So far as concerns smoking tobaccos, however, certain grades of Burley are interchangeable, more or less, with the Maryland types in both foreign and domestic demands.

As has been stated the greater portion of the Maryland tobacco crop is exported to France and Holland, about 80% of the crop (20,000 hogsheads) going to these two countries. While the proportion of the crop taken by the two countries varies from year to year, France takes, on an average a somewhat larger number of hogsheads than Holland. The requirements for the French and the Holland trade are somewhat different so that Maryland tobacco is usually divided into the French type and the Holland type. The Holland type is light in color and in body and commands the highest prices. France takes principally the red grades having somewhat more body. There are, of course, various grades of each type. The type of tobacco obtained by the grower depends largely on the variety of seed used, the nature of the soil, the fertilizers and cultural methods used and the conditions under which the tobacco is cured and handled. Seasonal conditions also may play an important part. Both the Holland and the French types may be grown on the same farm. On account of the higher prices for Burley and Flue-Cured tobacco in recent years there has been a considerable increase in the domestic demand for the higher grades of Maryland leaf, adapted to the manufacture of cigarettes. Some 5000 or 6000 hogsheads are being used each year for domestic manufacture.

Generally speaking, the quantities of the different export types of tobacco purchased each year by foreign countries varies considerably with the relative supply and prices of suitable grades of each type. From what has been said regarding the trade demand for Maryland tobacco it will be seen that as an export type it must meet a certain amount of competition from other export types and even in that class of trade for which it is specially suited Maryland tobacco does not enjoy a monopoly. On the other hand, the higher grades are in considerable demand for domestic manufacture in addition to finding a steady market in Europe. It appears to be the view of dealers that there has been a gradual but general decline in the quality, as well as in the quantity produced, of Maryland tobacco. If the foreign and the domestic demand for the Maryland types are to be expanded or even maintained on the present basis the growers should use every effort to improve the quality of their crop as well as obtain reasonably good yields. A market for the fine grades is practically assured while the inferior grades, as a rule, will be taken only at very low prices. Prevailing prices for the better grades would insure good profits if it were not that the large proportion of poor grades usually brings the average price received by the growers down to a low figure.

THE OLDER VARIETIES OF MARYLAND TOBACCO.

Tobacco has been cultivated in southern Maryland for nearly three centuries and some of the sorts now under cultivation doubtless are among the oldest commercial varieties in existence. The native Maryland types may be divided into a Broadleaf group and a corresponding Narrowleaf group based on the comparative shape of the leaf. In shape and size of leaf the Broadleaf group of today closely resembles the Broadleaf or Seedleaf group of cigar tobaccos extensively grown in other states and, in fact, it is very probable that the latter are merely sub-varieties or strains of the Maryland Broadleaf. It is also probable that the White Burley originated as a so-called mutation or sport of Maryland tobacco.

MARYLAND BROADLEAF.

Under this head are included those sorts which produce a comparatively wide and large leaf. The Broadleaf sorts as a whole produce a leaf of less body with a tendency toward lighter colors than the Narrowleaf and the burning qualities are also likely to be better. The distance between leaves on the stalk is quite variable and a distinction is usually made between the ordinary Broadleaf sorts in which the leaves are rather wide apart on the stalk and those in which the leaves stand close together on the stalk. The latter are known as "Broadleaf, thickset" sorts. The thickset sorts are likely to require less suckering than the ordinary Broadleaf, but there is more danger from "house burn" in curing the thickset. The various strains of Broadleaf grown by farmers also differ among themselves in many other minor particulars, almost every strain possessing some special merits as well as some objectionable characters, and it is impossible to single out any particular strain of Broadleaf as being the best in all respects.

Maryland Narrowleaf.

As indicated by the name, this group includes those sorts which produce a comparatively narrow and small leaf. As a whole the Narrowleaf sorts produce a leaf of more body and life than the Broadleaf and tend to give fine red colors with more lustre. On the whole, the Narrowleaf and Broadleaf sorts average about the same number of leaves per plant and the increased size of leaf in the Broadleaf is pretty well offset by the heavier body of the Narrowleaf so that there is not much difference in the yields from the two groups. In some measurements made with strains of Broadleaf and Narrowleaf grown under similar conditions on the Norfolk Sand type of soil it was found that the leaf of the Broadleaf averaged about 15 per cent. larger than that of the Narrowleaf, while the weight per square foot of the Narrowleaf averaged about 17 per cent. greater than that of the Broadleaf. As is the case with Broadleaf, those strains in which the leaves stand close together on the stalk are known as "Narrowleaf, thickset," as distinguished from the ordinary Narrowleaf strains in which the leaves are spaced farther apart on the stalk. There are a great many more or less distinct strains of Narrowleaf differing from one another as regards distance between leaves on the stalk or other characteristics.

It will be seen that of the Broadleaf and the Narrowleaf groups each possesses certain advantages over the other and the same is true as to the various sorts or strains of each. Under average conditions in Southern Maryland it is believed that the Broadleaf sorts will give larger yields of the light-bodied, colory leaf which makes up the finer grades, although desirable strains of Narrowleaf may bring better returns under certain conditions. Experience has shown, however, that some strains of Broadleaf are decidedly superior to others, both as to yield and quality, and this is true also of the Narrowleaf strains.

Some New Varieties.

The importance of choosing the right variety of seed for planting is especially marked in a crop like tobacco where quality as well as yield counts for so much. The ideal variety of tobacco is one giving the maximum yield of high-grade leaf and, of course, possessing other desirable characters of less importance. In the great majority of cases varieties or strains possessing some very valuable characters are deficient in other desirable characters and this condition was found to apply to Maryland tobacco. Furthrmore, it was found that many farmers are growing crops of tobacco lacking in uniformity; that is, they are growing not one, but several types in the same field. It seemed probable, therefore, that the discovery or production of varieties combining the most valuable characters of the various old Maryland sorts would make it possible to increase the profitableness of tobacco culture. It seemed worth while, also, to study the value of systematic selection of seed in increasing the uniformity and, therefore, the profitableness of the tobacco crop.

Experience has shown that by crossing two varieties of tobacco which differ in habits of growth or other characters it is possible, under proper conditions, to obtain types which possess various combinations of the characters belonging to the two parents. For example, if a variety which produces *a large number of leaves of small size* is crossed with a variety which produces *a small number of leaves of large size,* some of the second generation plants from the cross should have *a large number of leaves of large size,* while the others will have leaves more nearly like the one parent or the other. The offspring from a cross between two different strains or varieties are called hybrids. As a rule, the plants of the first generation of tobacco hybrids are uniform and resemble both parents more or less, but in the second generation there is normally a breaking up into various combinations of the parental characters. If plants showing desirable combinations of characters are saved for seed and the process of selection followed systematically year after year until the selections breed true to type and produce a uniform crop of tobacco, it is possible to thus obtain valuable new strains or varieties.

Maryland-Connecticut Broadleaf.

This type has been developed from a cross of Maryland Broadleaf with Connecticut Broadleaf made in 1904 by the late W. W. Cobey. Connecticut Broadleaf under proper conditions produces a large and broad leaf of fine texture and light color. The cured leaf closely resembles Maryland tobacco in many respects. By systematic selection of promising plants from this cross a type has been developed which averages about 25 leaves to the plant and the leaves are large, broad and set moderately close together on the stalk. The tobacco cures well and has good texture. A representative plant of this type is shown in figure 1.

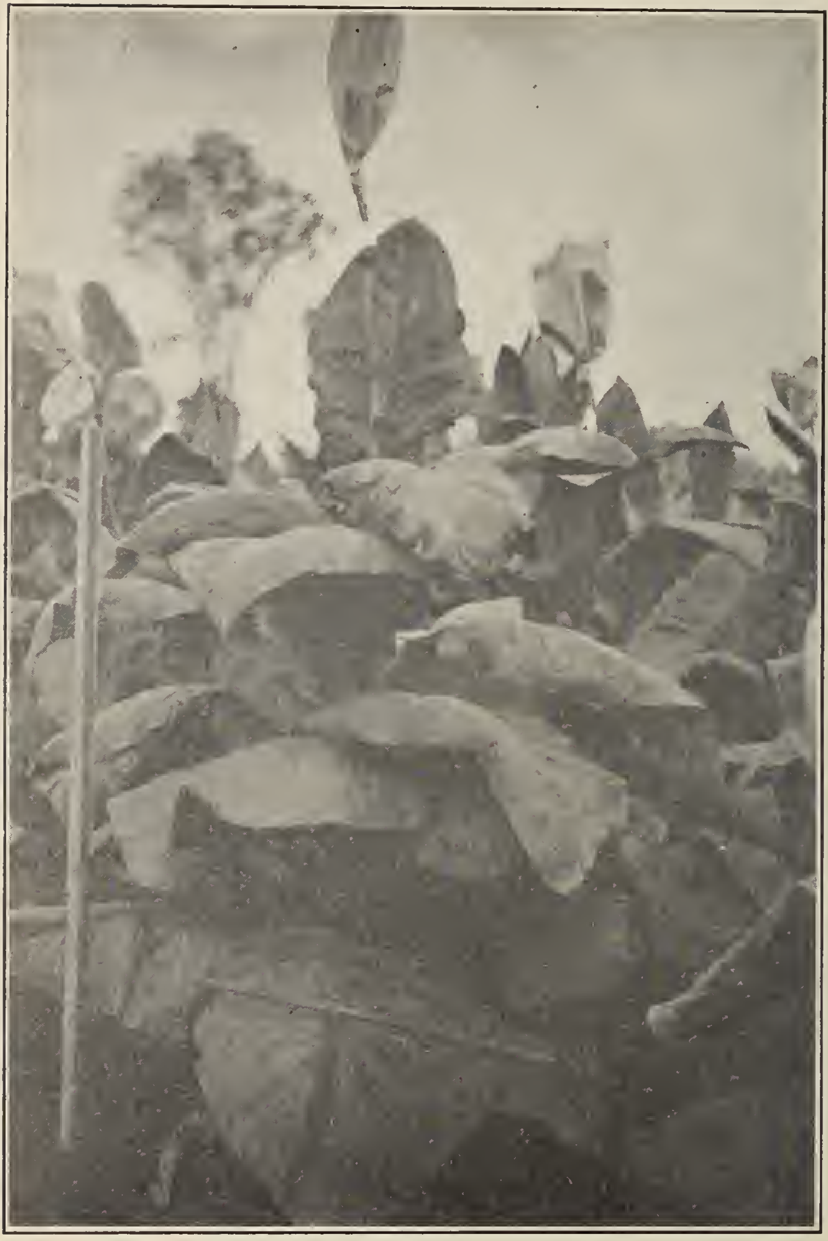

Fig. 1—A typical plant of the Maryland-Connecticut Broadleaf. This plant as shown contains 30 leaves. The middle leaf is 33 inches long and 22 inches wide.

The Maryland-Connecticut Broadleaf has been grown for five years on our test plots at Upper Marlboro with yields ranging from 900 to over 2,000 pounds per acre under different conditions. A number of farmers have grown it with success. One grower who has raised this type for the past three years states that in a crop of 80,000 plants he obtained an increase in yield of 25 per cent. and received 10½ cents per pound for the crop as against 8½ cents for his original variety.

MARYLAND-BURLEY BROADLEAF.

This type was originated by crossing Maryland Broadleaf with White Burley, the cross having been made in 1905 on the farm of Mr. J. H. Drury, of Calvert County. The White Burley, as has been stated, is similar to Maryland Broadleaf in general habits of growth and in properties of the cured leaf. Indeed, Burley seed is extensively used in the Upper-County district. The first generation from this cross made a remarkable growth, the middle leaf on one plant measuring 26 inches wide and 42 inches long. By systematic selection for several years a strain has been developed which has four desirable characteristics, namely: (1) it produces a very large leaf, (2) the top leaves are almost as long as the middle ones, (3) it produces but few suckers, (4) the quality of the cured leaf is good.

Mr. Drury has been the most extensive grower of this variety and it has given good results in his hands. A typical plant of the Maryland-Burley Broadleaf is shown in figure 2.

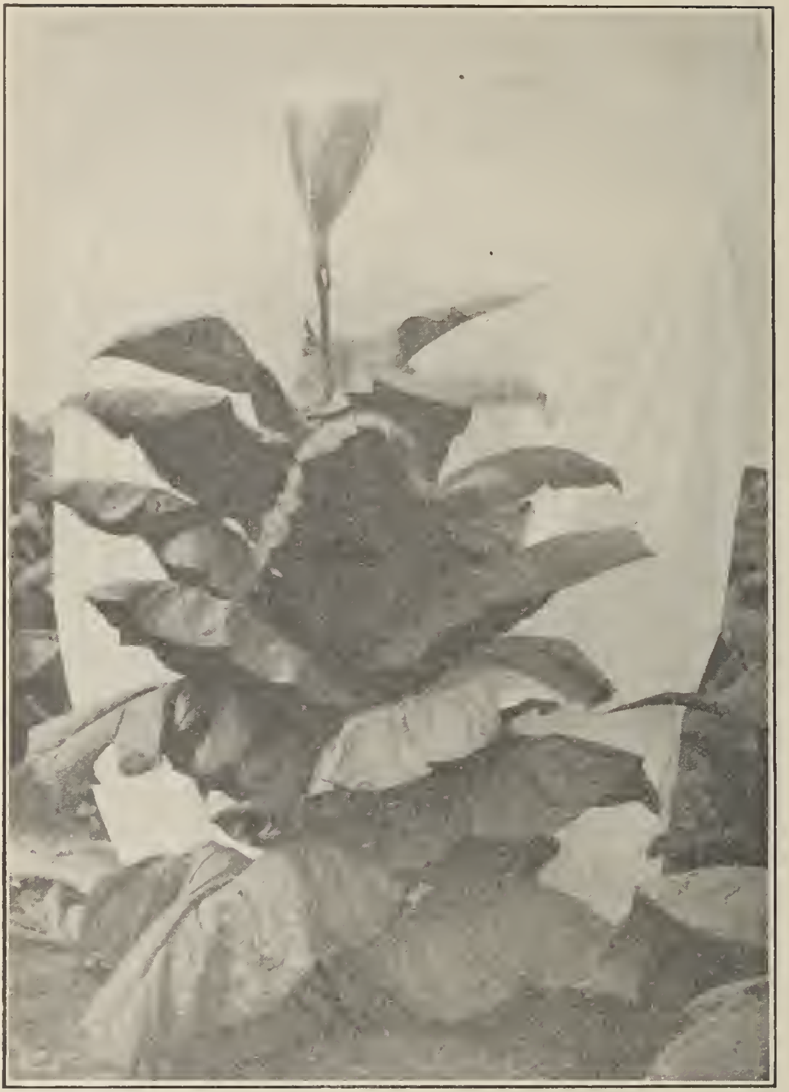

Fig. 2—A typical plant of the Maryland-Burley Broadleaf. The plant shown above contains 35 leaves. The middle leaf is 38 inches long and 23 inches wide. Note the method of covering flower head with paper bag to prevent crossing.

Maryland Mammoth.

This is the most interesting and perhaps the most promising of the new varieties. It derives its name from the extraordinary height reached by the plant and the large number of leaves produced. It is remarkable in that the plant does not bloom in the field under normal conditions, but continues to increase in height and in number of leaves till killed by frost. If not topped the plants frequently produce more than 100 leaves. If transferred to the greenhouse late in the season the plants finally bloom, usually in December, and develop seed. Or, if the plant is cut in the usual manner and the root stock transplanted in the greenhouse, suckers will develop and these soon bloom and set seed.

There are two forms of the Mammoth and these were obtained in different ways. The Broadleaf Mammoth appeared in a selection of Maryland Broadleaf made on the farm of Mr. James A. Gray, of Charles County. This form of the Mammoth, which possesses a rather short, broad leaf, has not been grown commercially since the leaf in the field is of a very dark green and gives dark, undesirable colors when cured. The Narrowleaf Mammoth appeared in the second generation of a cross between Maryland Broadleaf and Maryland Narrowleaf. This form of the Mammoth has given excellent results on our plots and in the hands of a number of farmers who have tried it in a small way. Since its first appearance this form has always come true to type, just as has the broadleaf form of Mammoth which developed in a Maryland Broadleaf without crossing, so far as known. We have never observed any lack of uniformity in either form of the Mammoth and in this respect they do not seem to differ from the old established varieties.

One of the most obvious advantages of the Mammoth is the large number of leaves which it will produce and, of course, the farmer can control the number of leaves left to develop by regulating the height of topping, according to the fertility of the soil, the seasonal conditions, etc. On strong land under favorable conditions as many as 50 leaves of good size per plant may be produced, while, if necessary, the plant may be topped to only 15 or 20 leaves. The leaf is of desirable shape and will grow as large as that of the standard Maryland varieties. Another very valuable characteristic of the Mammoth is that it is almost entirely free from suckers. As one would expect from the great numbers of leaves of large size which the plant produces, the yield per acre is decidedly higher than can be obtained from other varieties. The more fertile the soil the greater the gain in yield from the Mammoth for only a certain number of leaves will be produced by the ordinary varieties no matter how fertile the soil may be. Two typical Mammoth plants are shown in figure 3.

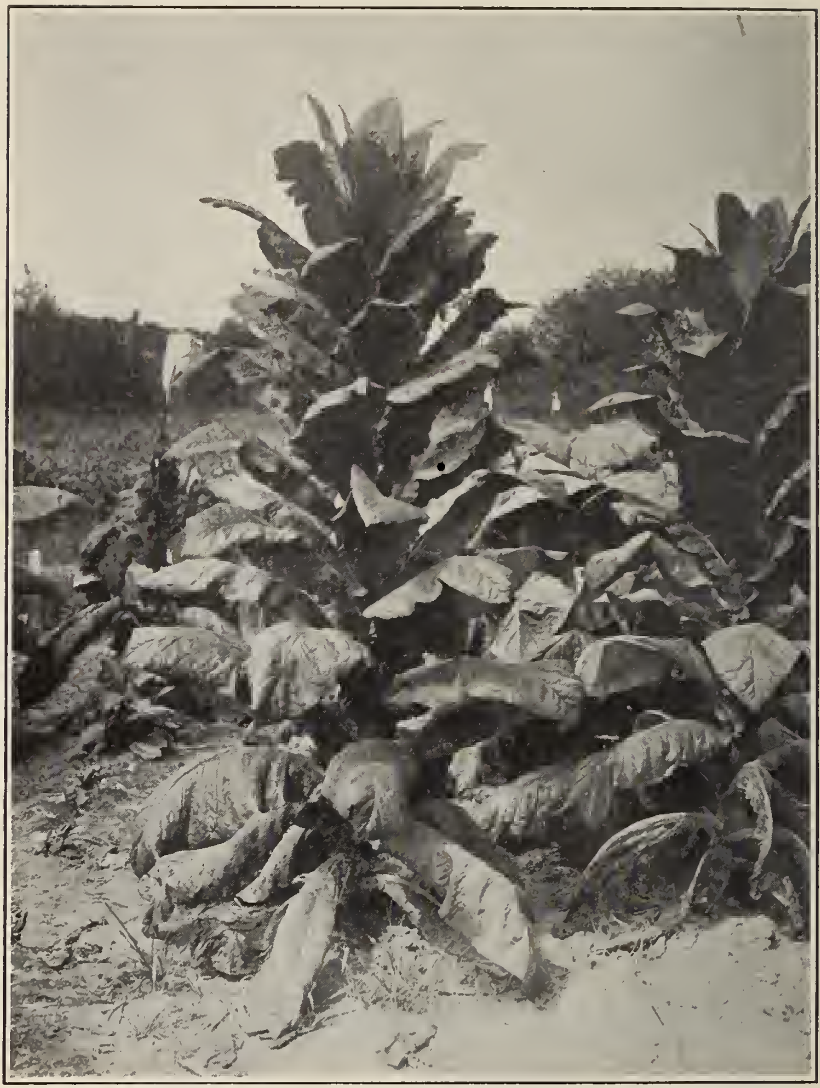

Fig. 3—Two plants of the Maryland Mammoth variety. At the time this photograph was taken the plant in center had developed 87 leaves. After transplanting in the greenhouse it finally bloomed, having produced 111 leaves.

The Mammoth cures down of fine texture and yields an unusually large percentage of bright leaf. Small quantities of seed were distributed to 25 farmers in 1912 all of whom reported good results and without exception all asked for seed again the next year. One grower who produced a hogshead of this variety said, "It will be the best hogshead of tobacco ever received in Baltimore.'' On account of the extraordinary height of the plant and the number of leaves, the stalk is rather large at the time of harvesting but tests have shown that the proportion of stalk to leaf really is less in the Mammoth than in other varieties. (See table on page 150).

Those growing the Mammoth for the first time should bear in mind that the plants should be topped as soon as the desired number of leaves have appeared. There is no flower head to break out and it is only necessary to pinch out the bud at the crown when the plant has formed from 25 to 40 or 50 leaves. It requires good judgment, of course, to top to just the right number of leaves for best results as much depends on the soil and weather conditions. The mistake should not be made of trying to grow too many leaves per plant. For average conditions 30 to 35 leaves probably is about right. The distance of planting should be about the same as for other varieties.

HOW TO GROW SEED OF THE MAMMOTH.

As the Mammoth does not bloom in the field under normal conditions, special methods for obtaining seed must be adopted. It is useless to leave plants untopped with the idea that these may develop seed before frost. Failure to obtain seed for the next year's crop has been the principal difficulty in the way of a more extensive use of this variety by farmers. If the right methods are followed, however, it is a simple matter to obtain plenty of seed.

The simplest method is to grow a number of plants in flower pots or buckets about 8 inches in diameter or in other suitable receptacles. The pots are filled with good soil and the plants are set out at the usual time for transplanting tobacco. The plants must be given a reasonable amount of attention and can be conveniently grown about the house along with the flowers. They should receive plenty of sunlight and must be watered frequently. It is well to allow the leaves to wilt during the hotter portion of the day. The pots or boxes of course should be placed where they are not likely to be overturned or the plants otherwise damaged. The essential features are to grow the plants in a comparatively small quantity of soil but with plenty of sunlight and sufficient water. Under these conditions the plants are very much dwarfed and they will bloom freely, giving a good yield of seed. The dwarfing or stunting should not be carried to an extreme for then the plant does not grow nor will it bloom. The plant shown in figure 4 gives a good idea of how the Mammoth behaves when properly dwarfed.

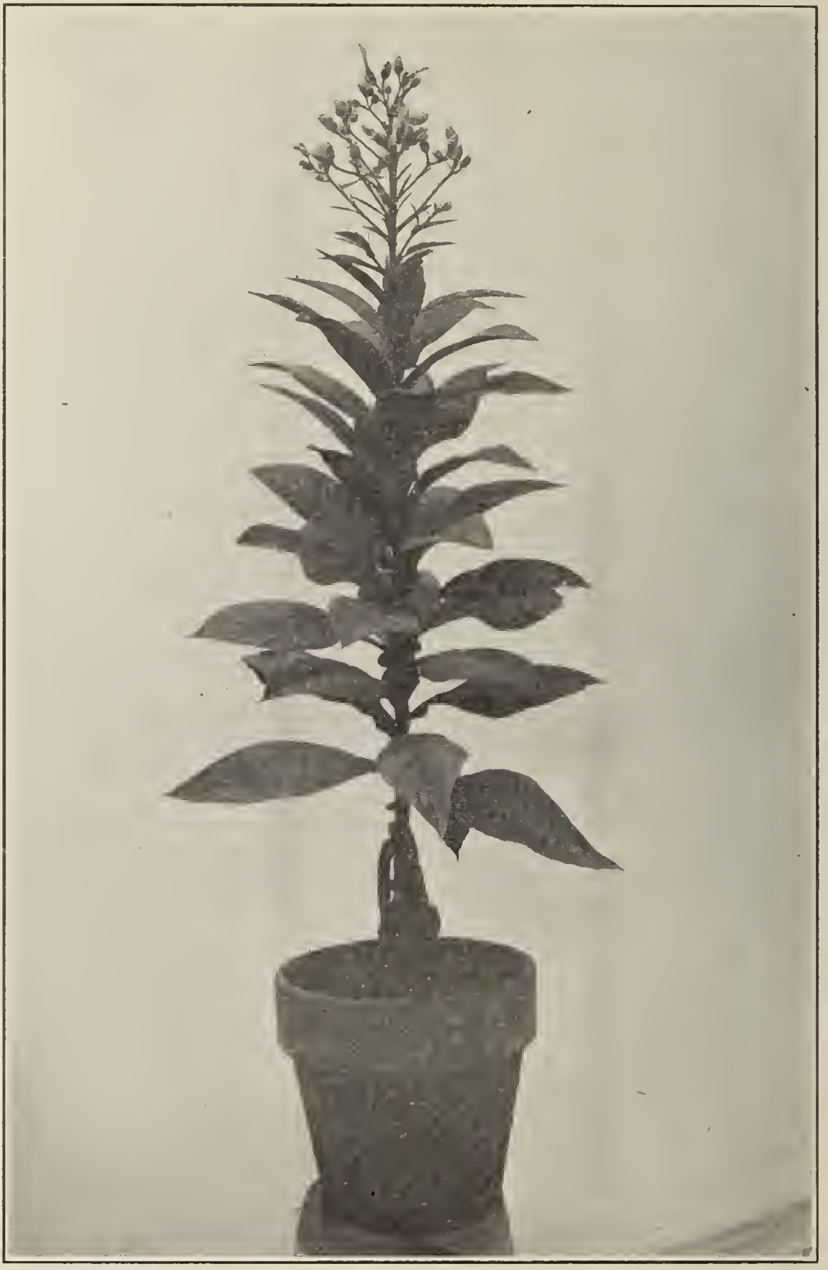

Fig. 4—A plant of the Mammoth variety as represented in figure 3 (page 144), showing method of dwarfing by growing in pots, so as to force the plant to bloom and set seed. This is the proper method to follow in growing seed of the Maryland Mammoth

It has been found by a large number of tests that seed of the dwarfed plants give the same results as that obtained by allowing the giant plant to develop seed after being transferred from the field to the greenhouse. Dwarfing the plants for three successive generations has had no effect on the size of the offspring. The plan of digging up the plants in the field as soon as there is danger of frost and resetting in good soil in large boxes or tubs usually gives good results, *provided* there is at hand a greenhouse or other suitable enclosure in which the plants will be protected from cold but will receive plenty of sunlight. A third method which we have often used is to first cut the plant in the field in the usual manner and then transplant the root stock or stump. The suckers which develop soon bloom and under favorable conditions considerable seed will result. The chief difficulty with this method is that during the mid-winter months there is not sufficient sunlight for the development of the seed and most or all of the young seed pods drop off. It is usually necessary to keep the plants till early in the spring before seed can be obtained and often it is then too late to plant the new crop. Everything considered, the method of dwarfing the plants by growing in small pots is recommended as the simplest and most reliable.

When the Mammoth is crossed with other varieties the offspring of the first generation lose the Mammoth character and the plants bloom like the ordinary varieties. In growing the seed it is especially important, therefore, that the seed heads be covered with paper bags to prevent accidental crossing as described on page 151.

Some Results of Variety Tests.

During the past few years a number of field tests have been carried out at Upper Marlboro as to the yield and quality of the three new varieties of tobacco which have been described as compared with standard Broadleaf and Narrowleaf sorts. All varieties were grown on adjoining plots under the same conditions and were handled in exactly the same manner, as far as possible. The tests were made on the Sassafras Sandy Loam type of soil, which gives good yields but is too heavy and too strong to produce tobacco of fine quality, and on the Norfolk Sand type which is very loose and poor in humus and produces tobacco of fine quality although the yields are usually rather small. Thus, these two soil types cover pretty well the range of the tobacco soils. A large number of varieties and strains have been tested so that the same strains of the new varieties could not be included each year. The results shown in table I, however, give a good idea of the yields and the market values of the new varieties as compared with Broadleaf and with Narrowleaf. The values were obtained by submitting representative samples to several buyers and taking an average of the valuations furnished by these buyers. The yield given in the table for the Maryland-Burley Broadleaf on the Sassafras Sandy Loam in 1913 is somewhat too low as the stand was not so good as on the other plots.

Table I. Results of variety tests with tobacco on two soils types at Upper Marlboro.

VARIETY	GROWN ON SASSAFRAS SANDY LOAM						CROWN ON NORFOLK SAND					
	Yield per acre, in lbs.			Value of crop per acre			Yield per acre, in lbs.			Value of crop per acre		
	1910	1912	1913	1910	1912	1913	1909	1910	1912	1909	1910	1912
Maryland Broadleaf	930	1015	1235	$ 49.35	$ 71.80	$ 79.60	1152	830	1010	$122.94	$ 76.02	$ 77.30
Maryland-Connecticut Broadleaf	1086	945	1360	72.63	64.05	86.40	1292	1080	940	134.64	110.94	71.40
Maryland-Burley Broadleaf	......	1090	1095	....	74.80	71.15	1040	......	1280	95.04	....	125.10
Maryland Mammoth	1221	1230	1530	126.66	96.35	120.30	......	1056	1380	......	117.06	123.50
Maryland Narrowleaf	966	985	1370	65.31	64.40	88.10	1080	936	540	113.37	89.04	51.20

For some reason not known the yield of Maryland Narrowleaf on the Norfolk Sand was very low in 1912 but otherwise there is but little difference in the average yield or value of the crop between the old Broadleaf and Narrowleaf varieties. Both varieties give better yields on the Sassafras Sandy Loam than on the Norfolk Sand but the tobacco was of much poorer quality. The Maryland-Connecticut, and the Maryland-Burley gave about the same yields and quality of tobacco as the old varieties on the Sassafras Sandy Loam. On the very light Norfolk Sand, however, these new varieties gave considerably better yields than the old varieties and the quality of the cured leaf was equally as good.

The Mammoth gave an average increase in yield of 20% over the combined average of all other varieties on the Sassafras Sandy Loam and an increase of about 15% on the Norfolk Sand. The average value of the crop produced on the two types of soil exceeded the average value of the crops from the other varieties by about $30.00 per acre. Special attention should be called to the valuation of the tobacco grown on the Sassafras Sandy Loam from the Mammoth as compared with the other varieties. The much higher value per acre of the Mammoth tobacco is only partly due to the increased yield, and the value of the cured leaf per pound of the Mammoth averages nearly 30% higher than that of the other varieties. The important point is that the Mammoth not only gives larger yields but also produces a decidedly better quality of leaf than other varieties when grown on the heavier and more fertile tobacco soils. This is due mainly to the fact that the increased fertility of these soils goes to the development of a large number (30 to 40) of leaves of fine texture on each plant while for other varieties, which produce a much smaller number of leaves, the increase in yield means leaf of heavy body which cures up of poor quality.

The results of these tests indicate that the Maryland-Connecticut and the Maryland-Burley are desirable types for growing on the lighter soils which produce tobacco of fine quality while the Mammoth gives promise of proving at least equal to the best varieties on these light soils and decidedly superior to all other varieties on the heavier. more fertile tobacco soils on which other varieties produce tobacco of comparatively poor quality.

Proportion of Leaf to Stalk in Maryland Tobacco.

So long as the stalk is stout enough to withstand damage from storms there is nothing to be gained by producing a large stalk unless the weight of cured leaf is correspondingly increased. An unduly large proportion of stalk simply constitutes an unnecessary drain on the fertility of the soil and an increased amount of labor in handling.

To obtain some idea of the proportion of stalk to leaf in the varieties which have been discussed the weights of both stalks and leaves from the 1913 plots were taken at the time of stripping. The results are shown in Table II.

Table II. Showing the proportion of leaf to stalk in different varieties Maryland Tobacco.

NAME OF VARIETY	Weight of leaves of 100 plants	Weight of stalks of 100 plants	Per centage of leaf	Per centtage of stalk
Maryland-Burley Broadleaf......	30 9 lbs.	12.7 lbs.	70.9%	29.1%
Maryland Mammoth.............	35.9 “	15.0 “	70.5%	29.5%
Maryland Broadleaf.............	34.3 “	18.6 “	64.8%	35.2%
Maryland-Connecticut Broadleaf.	31.2 “	17.9 “	63.5%	36.5%
Maryland Narrowleaf............	28.2 “	16.9 “	62.5%	37.5%

These results show that the Maryland-Burley Broadleaf and the Maryland Mammoth produce a considerably lower proportion of stalk than the other three varieties.

CULTURE OF UNDEVELOPED TOBACCO HYBRIDS IS NOT RECOMMENDED.

As has been already stated, by crossing two varieties of tobacco it is possible eventually to obtain new varieties combining desirable characters of both parent varieties. The process of development, however, usually requires several years of careful and extensive selection and testing. As a rule the first generation from a cross is quite uniform and may appear to be far superior to the parent varieties, especially in vigor. Furthermore, the cured leaf may show good quality. The practical grower, however, should beware of using seed of these hybrids for producing a commercial crop. Numerous trials of such hybrids have been made in Maryland and in other tobacco growing States and buyers have often condemned the tobaccos produced.

The principal reason for the unsatisfactory results is that, no matter how promising the first generation of a cross between two varieties may be, the plants grown from seed of this first generation will show the greatest variety of combinations of the characters of the parents and there will be no uniformity in the crop. There will be striking differences in the color, texture and other properties of the cured leaf and the tobacco is really a nondescript product.

On the other hand, if proper methods of seed selection are applied for a number of years it is possible eventually to develop new sorts which will produce uniform crops and may have characteristics which make them superior to the standard varieties. When this condition of uniformity has been reached the new sort is no longer a hybrid, in the ordinary sense of the word, and is entitled to consideration as a new variety. The question of uniformity in the crop having been emlinated, the claims of the new variety should be judged by comparison with standard varieties as to habits of growth, productiveness and quality of the cured leaf.

Selection of Seed Plants and Saving the Seed Under Bag.

In the preceding pages attention has been called to the importance of selecting a good variety for planting, but, having chosen some variety, it is equally important to keep it pure and up to the standard by carefully selecting good seed plants and using a suitable method to prevent crossing with other varieties. Under ordinary conditions any variety or strain of tobacco will eventually become more or less mixed with other sorts and for this reason there is little uniformity in the crops grown on most farms at the present time.

One of the simplest and cheapest methods of improving the value of the average tobacco crop in Maryland is to select good seed plants, choosing *only* those plants which conform to a definite type considered as the ideal. The opinions of farmers will differ in some particulars as to what constitutes the ideal type but in general it is one which produces a comparatively large number of leaves of large size, arranged rather close together on the plant, produces but few suckers and ripens and cures well. These characteristics are favorable to the production of the largest yield of the most valuable class of tobacco which can be grown on the soil to be used.

Having fixed on a definite type of plant as the ideal, it should be closely followed year after year and no plant should be used for seed which does not conform to this type. In this way the inferior strains in the mixed type will be weeded out and the crop will become more uniform from year to year if the selection is done with proper care. The field should be gone over several times and a large number of plants selected in the beginning. By further observation and study the number of selected plants can be gradually reduced till the right number for seed is reached. The selection of seed plants will accomplish little unless carried on systematically and with careful attention to the points mentioned.

The advantages of selecting good seed plants, true to type, are lost if crossing with other sorts is allowed to occur. Some crop plants appear to be benefitted by free crossing between plants but this is not the case with tobacco. It is true, nevertheless, that under ordinary conditions crossing does occasionally take place between tobacco plants in the same or neighboring fields. If crossing is to be prevented special precautions must be taken. Even crossing between selected seed plants should be avoided, for plants which seem to belong to exactly the same type may be different in their internal makeup and if allowed to cross the farmer will really be growing hybrids.

A cheap and effective method of preventing crossing is to cover the flower head with a 12-pound manila paper bag such as is used in grocery stores. The bag should be placed over the flower head at about the time blooming begins. If any blossoms have already opened it is important that these be removed when applying the bag. The suckers and small leaves just below the flower head proper are removed and the mouth of the bag securely tied to the stalk just beneath the lower branches of the flower head. Figure 2 shows the method of applying the bag.

After a week or ten days the bags should be taken off temporarily, the dead blossoms shaken out and the bags readjusted to accommodate the growth of the seed head. The seed heads should be examined from time to time and any bags which become torn should be replaced with new ones. It is well to leave the bags on the seed heads till the seed are shelled out so as to prevent loss or mixing of seed.

THE MARYLAND AGRICULTURAL EXPERIMENT STATION

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The Quality of Grass and Rape Seed Found in Maryland Markets in 1913.

By C. P. Smith.

Introduction.

The present bulletin completes the publication of the results of our 1913 inspection work amongst the Maryland field seed vendors and also presents the text of the Maryland seed law of 1914, effective October 1, 1914. For the latter turn to page 177. Experiment Station Bulletin 179 treated the clover and vetch seed sampled in 1913, and herein are now treated, in like manner, dwarf Essex rape and the true grasses of agricultural importance, namely—timothy, Kentucky and Canadian bluegrasses, German and Hungarian millets, orchard grass and redtop. The redtop of the seed trade is a true grass and should not be confused with red clover, as has been done, in certain cases having led to serious business complications. Rape is the one representative of the mustard family classified as a field seed, the other familiar cultivated mustards being all garden or truck-crop plants, their seeds being commonly retailed in smaller packages than bushel lots.

The official samples herein reported were taken at the same time and under the same general conditions as were the clover and vetch samples published in Bulletin 179, and the first four paragraphs of said bulletin might properly be repeated here. This publication and that one should therefore be used and filed together.

Differences in Analyses and Their Interpretation.

The paragraph under this heading in our last report applies equally well here to timothy and the millets. For the other grasses, however, a more liberal allowance for variation should be made, especially as to the precentages of purity and inert matter; less so for foreign seed. We do not care, at present, to offer even a preliminary set of figures to guide one in judging whether the variation concerned is a reasonable one or not; but we advise that considerable leniency be exercised until we and others have studied the subject further, especially as to orchard grass.

Explanation of Tables.

The tabulations follow the same scheme adopted for the preceding bulletin. The dealers name given first is that of the person or firm in whose house the sample was taken, below being added the name of the wholesaler or agent furnishing the analysis, etc., when such is evident. When only one person or firm is mentioned, that person or firm alone assumes responsibility for the labeling. The word "unlabeled" is here used to signify that the analysis was lacking, the goods being therefore "unlabeled" in terms of the requirement of the law, though the merchant or wholesaler's tag and name may have been present and recorded by the inspector. Hence when a wholesale firm's name is given below in the case of a sample recorded as "unlabeled," said firm evidently shipped the package or packages out without analysis; but when the name of the local vendor appears alone and no analysis is recorded as given, it usually means that said vendor has carelessly, or intentionally, removed the analysis tag that probably was present upon delivery of the goods to him. The analysis recorded above, following "G," is that supplied by the dealer, while below same, following "F," is recorded the test, or average of tests, obtained from the sample in our laboratory. In most cases where our results have seemed unreasonably lower or higher than the given analysis, a second test, and sometimes a third, has been made and the whole sample studied critically. As before, each kind of seed is tabulated separately and the towns or post-offices arranged alphabetically within each table.

TIMOTHY.

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight. Pure Seed	Percentage by Weight. Inert Matter	Percentage by Weight. Foreign Seed	Approximate No. of Weed Seeds per lb.
	BALTIMORE.					
130124	J. Bolgiano & Son	G	97.33	1.24	1.43	
		F	98.47	0.83	0.70	3020
130127	" "	G	97.63	1.38	0.97	
		F	96.44	0.66	2.90	32163
130344	" "	G	97.37	1.49	1.14	
		F	92.34	1.93	5.73	25821
130346	" "	G	99.31	0.45	0.25	
		F	99.24	0.40	0.36	1510
130348	" "	G	84.79	4.75	10.46	
		F	82.94	5.96	11.10	96036
130583	" "	G	99.16	0.40	0.44	
		F	98.97	0.50	0.53	3171
130584	" "	G	98.50	----	----	
		F	98.20	1.00	0.80	3020
130585	" "	G	99.00	----	----	
		F	98.84	0.50	0.66	2718
130586	" "	G	99.12	0.19	0.69	
		F	98.67	0.23	1.10	2567
130587	" "	G	Unlabeled.			
		F	96.44	2.86	0.70	604
130588	" "	G	94.26	1.14	4.60	
		F	96.64	1.36	2.00	9362
130670	" "	G	98.75	----	0.65	
		F	99.24	0.50	0.26	2114
130714	" "	G	99.21	0.54	0.25	
		F	98.90	0.60	0.50	2265
130201	John J. Buffington & Co.	G	97.97	0.82	1.21	
		F	96.15	2.72	1.13	5738 A2*
130202	" " "	G	99.19	0.41	0.40	
		F	98.34	1.13	0.53	1359
130211	" " "	G	99.80	0.10	0.10	
		F	99.87	0.10	0.03	151
130325	" " "	G	99.61	0.29	0.10	
		F	99.77	0.13	0.10	302
130561	" " "	G	99.45	0.30	0.25	
		F	99.08	0.56	0.36	1812
130651	" " "	G	99.31	0.30	0.39	
		F	99.54	0.26	0.20	1812

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*Average of two tests.

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight			Approximate No. of Weed Seeds per lb.
			Pure Seed	Inert Matter	Foreign Seed	
	Baltimore—(Continued).					
130652	John J. Buffington & Co.	G	99.00	0.30	0.70	
		F	98.78	0.76	0.46	3624
130653	" " "	G	98.30	0.90	0.80	
		F	98.04	0.96	1.00	3624
130654	" " "	G	99.20	0.40	0.40	
		F	99.57	0.30	0.13	1057
130655	" " "	G	99.60	0.30	0.10	
		F	99.48	0.36	0.16	2265
130656	" " "	G	97.97	0.61	1.42	
		F	97.64	1.13	1.23	2416
130691	" " "	G	99.01	0.78	0.21	
		F	98.88	0.66	0.46	1057
130692	" " "	G	98.70	1.11	0.19	
		F	98.77	0.90	0.33	755
130693	" " "	G	99.61	0.20	0.19	
		F	99.47	0.20	0.33	604
130717	" " "	G	99.11	0.69	0.20	
		F	99.33	0.60	0.07	453
130718	" " "	G	98.08	0.77	1.14	
		F	97.94	1.23	0.83	4681
130719	" " "	G	99.30	0.40	0.30	
		F	99.20	0.60	0.20	453
13089	Griffith & Turner Co.	G	98.00	----.	----.	
		F	99.34	0.33	0.33	755
13090	" " "	G	96.00	----.	----.	
		F	98.27	0.96	0.76	3020
130164	Wm. G. Scarlett & Co.	G	99.50	0.37	0.13	
		F	99.10	0.60	0.30	604
130165	" " "	G	98.27	0.99	0.74	
		F	98.21	1.03	0.76	1510
130166	" " "	G	99.76	0.12	0.12	
		F	99.37	0.30	0.33	1661
130167	" " "	G	99.01	0.62	0.37	
		F	98.67	0.33	1.00	1812
130168	" " "	G	99.49	0.25	0.26	
		F	99.37	0.33	0.30	151
130217	" " "	G	98.51	0.62	0.87	
		F	98.40	0.70	0.90	2718
130218	" " "	G	99.51	0.43	0.06	
		F	99.94	0.03	0.03	0

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight: Pure Seed	Percentage by Weight: Inert Matter	Percentage by Weight: Foreign Seed	Approximate No. of Weed Seeds per lb.
	Baltimore—(Continued).					
130578	Wm. G. Scarlett & Co.	G	98.27	0.24	0.49	
		F	98.58	0.76	0.66	4179
130679	“ “ “	G	99.38	0.37	0.25	
		F	99.64	0.26	0.10	453
130680	“ “ “	G	99.01	0.74	0.25	
		F	99.30	0.50	0.20	906
130681	“ “ “	G	98.76	0.74	0.50	
		F	99.24	0.46	0.30	453
130689	“ “ “	G	98.76	0.99	0.25	
		F	99.07	0.53	0.40	604
130690	“ “ “	G	99.25	0.50	0.25	
		F	98.91	0.73	0.36	1661
130708	“ “ “	G	98.88	0.87	0.25	
		F	98.31	0.73	0.96	15251
130709	“ “ “	G	99.12	0.75	0.13	
		F	99.47	0.43	0.10	755
130710	“ “ “	G	99.50	0.25	0.25	
		F	99.57	0.36	0.07	755
130137	W. A. Simpson & Co.	G	99.50	----.	----.	
		F	99.51	0.33	0.16	302
130151	“ “ “	G	99.00	----.	----.	
		F	99.27	0.30	0.33	755
130152	“ “ “	G	98.00	----.	----.	
		F	97.77	1.03	1.20	2718
130153	“ “ “	G	96.00	----.	----.	
		F	97.04	1.40	1.56	9211
130369	“ “ “	G	99.13	----.	----.	
		F	99.34	0.36	0.30	1057
130370	“ “ “	G	99.47	----.	----.	
		F	99.00	0.73	0.26	2265
130371	“ “ “	G	99.65	----.	----.	
		F	99.76	0.17	0.07	0
130372	“ “ “	G	98.00	----.	----.	
		F	98.00	0.90	1.10	6644
130373	“ “ “	G	Unlabeled.			
		F	99.24	0.40	0.36	453
130662	“ “ “	G	99.50	----.	----.	
		F	99.54	0.23	0.23	453
130663	“ “ “	G	99.00	----.	----.	
		F	99.11	0.63	0.26	2114

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight.			Approximate No. of Weed Seeds per lb.
			Pure Seed	Inert Matter	Foreign Seed	
	Baltimore—(Continued).					
130664	W. A. Simpson & Co.	G	98.00	----	----	
		F	98.37	0.83	0.80	12533
130696	" " "	G	99.50	----	----	
		F	99.37	0.40	0.23	453
130697	" " "	G	98.00	----	----	
		F	98.51	0.86	0.63	3473
130186	Wiseman & Downs	G	99.91	----	----	
		F	99.84	0.10	0.06	151
130188	" " "	G	Unlabeled.			
		F	98.77	0.27	0.96	0
	BERLIN.					
130508	Berlin Hardware Co.	G	Unlabeled.			
		F	98.67	0.63	0.70	1208
130511	W. R. Purnell Co.	G	Unlabeled.			
		F	95.88	3.06	1.06	16761
	BETTERTON.					
130220	Turner & Son	G	99.19	0.41	0.40	
	John J. Buffington & Co.	F	99.24	0.40	0.36	151
	CAMBRIDGE.					
130298	Cambridge Seed & Grocery Co.	G	99.50	----	----	
	W. A. Simpson & Co.	F	99.27	0.33	0.40	6946
130303	Cambrdige Seed & Grocery Co.	G	Unlabeled.			
	Wm. G. Scarlett & Co.	F	98.24	1.33	0.43	1359
130304	Cambridge Seed & Grocery Co.	G	Unlabeled.			
	Wm. G. Scarlett & Co.	F	98.24	1.00	0.76	3020
130471	Cambridge Seed & Grocery Co.	G	Unlabeled.			
		F	99.04	0.66	0.30	5285
130473	Herbert Hearn	G	Unlabeled.			
		F	97.74	1.20	1.06	7399
130469	Olin LeCompte	G	98.07	1.02	0.91	
	John J. Buffington & Co.	F	97.51	1.33	1.16	6946
130293	Oliver Spedden	G	98.80	0.40	0.80	
	John J. Buffington & Co.	F	99.14	0.13	0.73	7399
130301	"Steamboat Wharf"	G	99.50	0.50	----	
	Griffith & Turner Co.	F	99.64	0.30	0.06	0
	CENTERVILLE.					
130252	G. D. Neavitt	G	98.75	0.75	0.50	
-	J. J. Buffington & Co.	F	97.80	1.50	0.70	3624

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Percentage by Weight.				Approximate No. of Weed Seeds per lb.
		Given / Found	Pure Seed	Inert Matter	Foreign Seed	
	CHESTERTOWN.					
130229	Davis & Satterfield	G	99.00	----.	----.	
	W. A. Simpson & Co.	F	99.17	0.40	0.43	1057
130231	Graham & Clements	G	Unlabeled.			
		F	98.67	0.63	0.69	2718
130233	R. F. Parks & Son	G	99.00	0.50	0.50	
	John J. Buffington & Co.	F	99.24	0.40	0.36	302
130404	R. F. Parks & Son	G	Unlabeled.			
		F	98.87	0.43	0.70	1510
130410	"Steamboat Wharf"	G	Unlabeled.			
	N. B. Lobe & Co., Baltimore	F	99.84	0.06	0.10	604
	CHURCH HILL.					
130237	E. S. Valliant & Son	G	97.97	0.82	1.21	
	J. J. Buffington & Co.	F	96.74	1.30	1.96	4379
	CRISFIELD.					
130553	J. P. Tawes & Bro.	G	99.50	----.	----.	
	W. A. Simpson & Co.	F	99.11	0.36	0.53	1510
	CUMBERLAND.					
130600	W. T. Coulehan & Bro.	G	Unlabeled.			
	Wm. G. Scarlett & Co.	F	98.30	0.70	1.00	6191
130603	W. T. Coulehan & Bro.	G	98.79	0.41	0.80	
	John J. Buffington & Co.	F	98.17	0.93	0.90	4832
130321	Flintstone Hardware Co.	G	99.81	0.19	0.20	
	John J. Buffington & Co.	F	99.84	0.10	0.06	604
130612	Flintstone Hardware Co.	G	99.61	0.29	0.10	
	John J. Buffington & Co.	F	99.50	0.30	0.20	302
130614	Flintstone Hardware Co.	G	Unlabeled.			
		F	98.80	0.50	0.70	1359
130617	Flintstone Hardware Co.	G	98.07	1.02	0.91	
	John J. Buffington & Co.	F	96.58	1.66	1.76	4077
130618	Flintstone Hardware Co.	G	98.38	0.61	1.01	
	John J. Buffington & Co.	F	98.67	0.60	0.73	2265
130606	Richards Bros.	G	99.50	0.25	0.25	
	Wm. G. Scarlett & Co.	F	99.27	0.40	0.33	4832
130607	Richards Bros.	G	Unlabeled.			
	E. W. Conklin & Son, Binghampton, N. Y.	F	99.57	0.30	0.13	151
130608	Richards Bros.	G	Unlabeled.			
	E. W. Conklin & Son	F	99.21	0.53	0.26	1963
130611	Richards Bros.	G	99.30	----.	----.	
	W. A. Simpson & Co.	F	99.51	0.33	0.16	302

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight. Pure Seed	Inert Matter	Foreign Seed	Approximate No. of Weed Seeds per lb.
	DENTON.					
130439	Nuttall Hardware Co.	G	98.07	1.02	0.91	
		F	98.34	0.90	0.76	1510
	EAST NEW MARKET.					
130480	Saxton & Parker	G	Unlabeled.			
		F	99.21	0.53	0.26	151
130477	C. H. Willis	G	Unlabeled.			
		F	98.80	0.60	0.60	3322
	EASTON.					
130269	Shannahan & Wrightson Hardware Co.	G	98.80	0.40	0.80	
	John J. Buffington & Co.	F	98.61	0.33	1.06	3322
130447	N. Tuthill & Son	G	98.78	0.40	0.82	
	John J. Buffington & Co.	F	98.21	0.96	0.83	3171
	ELKTON.					
130390	W. Sterling Evans	G	Unlabeled.			
		F	99.47	0.43	0.10	1359
130388	R. B. Frazer	G	96.00	----	----	
		F	96.41	1.93	1.63	6342
	FEDERALSBURG.					
130487	Covey & Williams	G	Unlabeled.			
		F	98.77	0.33	0.90	6191
130482	Holt & Hyland	G	Unlabeled.			
		F	99.67	0.23	0.10	151
	PORT DEPOSIT.					
130297	J. M. Campbell & Co.	G	98.07	1.02	0.91	
	J. J. Buffington & Co.	F	95.68	2.96	1.36	15704
	FREDERICK.					
130645	Frederick County Farmers' Exchange	G	98.30	----	----	
	E. W. Conklin & Son, Binghampton, N. Y.	F	98.90	0.70	0.40	4681
130646	Frederick County Farmers' Exchange	G	99.50	----	-	
	E. W. Conklin & Son	F	99.50	0.40	0.10	906
130647	P. L. Hargett & Co.	G	99.00	----	----	
	Whitney-Noyes Co., Buffalo, N. Y.	F	99.00	0.40	0.60	4832
130648	P. L. Hargett & Co.	G	97.83	0.96	1.21	
	Whitney-Noyes Co.	F	97.44	1.40	1.16	12684
130649	P. L. Hargett & Co.	G	98.78	0.40	0.82	
	John J. Buffington & Co.	F	97.73	1.11	1.16	4605
130631	Rhodes R. Kemp	G	88.75	----	----	
		F	98.11	0.96	0.93	4179

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Found / Given	Percentage by Weight. Pure Seed	Percentage by Weight. Inert Matter	Percentage by Weight. Foreign Seed	Approximate No. of Weed Seeds per lb.
	Frederick—(Continued).					
13058	Allen G. Quynn & Co.	G	Unlabeled.			
		F	99.40	0.30	0.30	4228
130633	Allen G. Quynn & Co.	G	Unlabeled.			
		F	99.51	0.36	0.13	0
130638	Thomas & Co.	G	99.50	----	----	
	E. W. Conklin & Son	F	99.61	0.26	0.13	604
130640	Thomas & Co.	G	98.50	----	----	
	E. W. Conklin & Son	F	98.11	1.06	0.83	9362
130639	Thomas & Co.	G	98.07	1.02	0.91	
	John J. Buffington & Co.	F	97.40	1.20	1.40	2718
	GOLDSBORO.					
130266	W. T. Jarman & Bro.	G	Unlabeled.			
		F	98.58	0.69	0.73	5285
130435	J. Frank Lane	G	Unlabeled.			
	Capelle Hardware Co., Wilmington, Del.	F	99.44	0.50	0.06	302
	HAGERSTOWN.					
130622	Elliott & Myers	G	99.12	----	----	
		F	99.64	0.20	0.16	0
130623	" "	G	Unlabeled.			
		F	99.17	0.50	0.33	3775
13038	Emmert Hardware Co.	G	Unlabeled.			
		F	99.30	0.40	0.30	0
130620	" " "	G	99.50	----	----	
		F	98.38	0.56	1.06	2718
130627	Ernest W. Miller	G	99.12	0.52	0.36	
		F	99.85	0.09	0.06	453
13022	Schindel, Rohrer & Co.	G	Unlabeled.			
		F	99.54	0.43	0.03	604
130624	" " "	G	99.50	----	----	
		F	99.22	0.50	0.28	1208
130625	" " "	G	98.50	----	----	
		F	97.94	1.06	1.00	2567
130626	" " "	G	99.00	---	---	
		F	98.37	0.83	0.80	2869
	HILLSBORO.					
130423	Stewart & Jarrell	G	Unlabeled.			
		F	97.04	1.80	1.16	3322
	HURLOCK.					
130466	W. C. Bradley & Son	G	99.30	----	----	
	W. A. Simpson & Co.	F	99.75	0.09	0.16	151

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Percentage by Weight				Approximate No. of Weed Seeds per lb.
		Given Found	Pure Seed	Inert Matter	Foreign Seed	
	Hurlock—(Continued).					
130291	Griffith & Charles	G	Unlabeled.			
		F	98.60	0.70	0.70	3020
130464	Griffith & Charles	G	98.54	----	0.74	
	Wm. G. Scarlett & Co.	F	97.94	1.20	0.86	1208
	LESLIE.					
130394	C. A. Benjamin & Co.	G	Unlabeled.			
		F	99.10	0.63	0.27	3322
	POCOMOKE.					
130541	Lloyd & Blaine	G	97.00	----	----	
	W. A. Simpson & Co.	F	96.58	1.76	1.66	9513
130529	Peninsula Produce Exchange of Maryland	G	Unlabeled.			
		F	99.37	0.30	0.33	1057
	PRINCESS ANNE.					
130549	C. H. Hayman	G	98.54	----	0.74	
	Wm. G. Scarlett & Co.	F	97.77	1.40	0.83	3020
	PRICE.					
130243	W. J. Massey	G	Unlabeled.			
		F	99.71	0.26	0.03	302
130413	W. J. Massey	G	99.48	0.31	0.21	
	John J. Buffington & Co.	F	99.10	0.80	0.10	302
	QUEEN ANNE					
130421	G. L. Jump	G	98.54	----	----	
	Wm. G. Scarlett & Co.	F	98.24	1.13	0.63	1208
	RIDGELY.					
130262	J. W. Simons	G	Unlabeled.			
	J. Bolgiano & Son	F	97.30	1.30	1.40	14345
130430	J. H. Smith	G	Unlabeled.			
		F	98.11	1.16	0.73	1208
	SALISBURY.					
130286	Dorman & Smyth Hardware Co.	G	Unlabeled.			
		F	99.90	0.07	0.03	151
130496	Dorman & Smyth Hardware Co.	G	99.20	0.10	0.20	
	Capelle Hardware Co.	F	99.14	0.43	0.43	2114
130290	Farmers & Planters' Co.	G	Unlabeled.			
	J. Bolgiano & Son	F	98.40	0.90	0.70	1057
130504	Farmers & Planters' Co.	G	98.79	0.41	0.80	
	John J. Buffington & Co.	F	97.70	1.20	1.10	3322

TIMOTHY—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Percentage by Weight.				Approximate No. of Weed Seeds per lb.
		Given Found	Pure Seed	Inert Matter	Foreign Seed	
	Salisbury—(Continued).					
130285	L. W. Gunby Co.	G	Unlabeled.			
		F	97.70	0.70	1.60	12684
130495	L. W. Gunby Co. J. Bolgiano & Son	G	Unlabeled.			
		F	83.17	5.90	10.93	82597
	VIENNA.					
130458	George W. Millard	G	Unlabeled.			
		F	99.77	0.20	0.03	604
130456	J. W. T. Webb & Son	G	Unlabeled.			
		F	99.81	0.13	0.06	755
130461	Winfield, Webster & Co. Wm. G. Scarlett & Co.	G	99.51	0.43	0.06	
		F	99.04	0.50	0.46	755

BLUEGRASS.

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight: Pure Seed	Percentage by Weight: Inert Matter	Percentage by Weight: Foreign Seed	Approximate No. of Weed Seeds per lb.
	ANNAPOLIS.					
130312	Henry B. Myers Co.	G	80.94	----	----	
	W. A. Simpson & Co.	F	79.79	19.90	0.31	5436
	BALTIMORE.					
*130115	J. Bolgiano & Son	G	88.11	6.66	3.07	
		F	86.96	7.66	5.38	19932
130117	" "	G	40.44	54.30	5.26	
		F	58.36	37.75	3.89	38505 A2†
130135	" "	G	77.54	22.17	0.29	
		F	80.16	19.43	0.41	4983
130136	" "	G	72.46	27.15	0.39	
		F	76.94	22.78	0.28	3171 A2
*130347	" "	G	89.13	7.33	3.54	
		F	86.90	11.95	1.15	6795 A2
*130589	" "	G	82.01	11.78	6.21	
		F	85.70	12.10	2.20	9513
130210	John J. Buffington & Co.	G	83.87	15.73	0.40	
		F	81.20	18.33	0.38	3624
130332	" " "	G	80.97	18.22	0.81	
		F	80.68	18.51	0.81	4983
130333	" " "	G	84.25	15.36	0.39	
		F	83.68	15.81	0.51	3624
130335	John J. Buffington & Co.	G	82.19	17.41	0.40	
		F	80.70	18.50	0.80	8607
13094	Griffith & Turner Co.	G	80.00	----	----	
		F	79.39	19.79	0.82	9966 A2
130107	Meyer-Stisser Co.	G	Unlabeled.			
		F	77.22	22.49	0.29	4077
‡130181	Wm. G. Scarlett & Co.	G	89.34	10.15	0.51	
		F	81.32	18.14	0.54	13137 A2
130182	" "	G	95.83	3.92	0.25	
		F	84.86	14.68	0.46	13137 A2
*130183	" "	G	93.00	4.00	3.00	
		F	83.85	13.50	2.65	7701 A2

*Canada bluegrass; all others Kentucky bluegrass.

†(A2) Average of two tests.

‡The difference in given and found analyses of samples 130181, -182 and -183 are evidently, as claimed by the merchant, due to differences in interpretation of the inert matter by the merchant's and the State's analysts. The given analyses of the four samples (130677, etc.) next recorded, were made by a different analyst in the merchant's laboratory, and same will be seen to check reasonably well with the figures obtained in the State laboratory.

BLUEGRASS—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight. Pure Seed	Percentage by Weight. Inert Matter	Percentage by Weight. Foreign Seed	Approximate No. of Weed Seeds per lb.
	Baltimore—(Continued).					
130677	Wm. G. Scarlett & Co.	G	82.35	17.16	0.49	
		F	82.94	16.91	0.15	1812
130698	“ “	G	87.00	13.00	0.00	
		F	87.92	12.55	0.03	453 A2
130699	“ “	G	93.07	6.44	0.49	
		F	94.86	5.04	0.10	906 A2
130703	“ “	G	86.14	11.88	1.98	
		F	84.75	14.77	0.48	4983 A2
130138	W. A. Simpson & Co.	G	80.94	18.87	0.19	
		F	82.96	16.75	0.29	3624
130190	Wiseman & Downs	G	Unlabeled.			
		F	71.28	23.01	6.71	29445
	CAMBRIDGE.					
130294	Oliver Spedden	G	83.87	15.73	0.40	
	John J. Buffington & Co.	F	85.48	14.01	0.61	4983
	COLLEGE PARK.					
130213	Agricultural Experiment Station	G	80.94	----	----	
	W. A. Simpson & Co.	F	80.57	17.04	2.39	4983
	CUMBERLAND.					
130597	W. T. Coulehan & Co.	G	89.34	----	0.51	
	Wm. G. Scarlett & Co.	F	88.90	10.44	0.66	9513
130320	Flintstone Hardware Co.	G	94.96	7.28	7.76	
	John J. Buffington & Co.	F	87.75	5.29	6.96	29145
	DENTON.					
130256	Nuttle Hardware Co.	G	89.34	10.15	0.51	
	Wm. G. Scarlett & Co.	F	81.24	18.04	0.72	10043 A2
	EASTON.					
130271	N. Tuthill & Son	G	83.87	15.73	0.40	
	John J. Buffington & Co.	F	84.30	15.09	0.61	6795
	FREDERICK.					
13070	P. Hargett & Co.	G	83.75	15.75	0.50	
	John J. Buffington & Co.	F	82.94	16.26	0.80	6795 A2
13060	Allen G. Quynn & Co.	G	Unlabeled.			
		F	70.81	26.32	2.87	25821
130637	Allen G. Quynn & Co.	G	82.35	----	----	
	Wm. G. Scarlett & Co.	F	84.50	15.20	0.30	2718
*130642	Thomas & Co.	G	84.96	7.78	7.26	
		F	85.12	12.95	1.93	9966 A2

BLUEGRASS—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given Found	Percentage by Weight. Pure Seed	Percentage by Weight. Inert Matter	Percentage by Weight. Foreign Seed	Approximate No. of Weed Seeds per lb.
	HAGERSTOWN.					
13025	Ernest W. Miller W. H. Small & Co., Evansville, Ind.	G F	80.56 81.06	18.90 18.61	0.54 0.33	8607
	POCOMOKE.					
130530	Pen. Produce Exchange of Maryland	G F	Unlabeled. 87.70	11.60	0.70	12684
	SALISBURY.					
130288	Dorman & Smyth Hardware Co. Capelle Hardware Co., Wilmington, Del.	G F	Unlabeled. 81.50	17.79	0.71	10872
130283	L. W. Gunby Co.	G F	Unlabeled. 52.55	38.81	8.64	93318
130492	L. W. Gunby Co.	G F	Unlabeled. 83.15	16.21	0.64	5436

GERMAN MILLET

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight.			Approximate No. of Foreign Seeds per lb.
			Pure Seed	Inert Matter	Foreign Seed	
	ANNAPOLIS.					
130559	Henry B. Myers Co.	G	98.00	----.	----.	
	W. A. Simpson & Co.	F	98.71	0.98	0.31	1904
	BALTIMORE.					
130123	J. Bolgiano & Son	G	99.38	0.46	0.16	
		F	99.47	0.52	0.01	168
130215	" "	G	98.17	1.14	0.69	
		F	98.87	0.63	0.50	2520
130353	" "	G	98.00	0.72	1.28	
		F	98.29	0.86	0.85	3920
130354	" "	G	98.13	0.72	1.15	
		F	97.79	0.60	1.61	4312
*130355	" "	G	98.31	0.48	1.21	
		F	98.29	0.48	1.23	3584
130591	" "	G	98.93	1.05	0.02	
		F	98.72	1.27	0.01	168
130592	" "	G	98.38	0.79	0.80	
		F	98.21	1.28	0.51	3864
130323	John J. Buffington & Co.	G	99.19	0.65	0.16	
		F	99.19	0.77	0.04	728
*130324	" " "	G	96.26	0.97	2.77	
		F	96.71	0.96	2.33	10248
130327	" " "	G	98.53	1.38	0.09	
		F	97.41	2.42	0.17	784
130329	" " "	G	99.36	0.56	0.08	
		F	99.31	0.46	0.23	840
130334	" " "	G	97.08	0.57	2.35	
		F	96.98	0.75	2.27	17024
130565	" " "	G	99.03	0.24	0.73	
		F	97.89	0.53	1.58	7728
130570	" " "	G	99.03	0.95	0.02	
		F	99.06	0.57	0.37	2632
130358	Wm. G. Scarlett & Co.	G	98.95	0.80	0.25	
		F	98.85	0.75	0.40	1176
130359	" " "	G	98.61	0.89	0.50	
		F	98.73	0.66	0.61	3528
130360	" " "	G	98.40	0.40	0.20	
		F	97.81	1.92	0.27	2464
*130361	" " "	G	98.50	----.	0.70	
		F	97.85	0.65	1.50	4816

*Hungarian millet.

GERMAN MILLET—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight.			Approximate No. of Foreign Seeds per lb.
			Pure Seed	Inert Matter	Foreign Seed	
	Baltimore—(Continued).					
130185	Wiseman & Downs	G	Unlabeled.			
		F	98.89	1.00	0.11	336
	BERLIN.					
130507	Berlin Hardware Co.	G	98.95	----	0.25	
	Wm. G. Scarlett & Co.	F	97.39	0.75	1.86	4536
130510	W. R. Purnell Co.	G	Unlabeled.			
		F	99.04	0.40	0.56	3192
	CENTERVILLE.					
130416	Wright & Lowe	G	Uncleaned.			
		F	99.64	0.27	0.09	448
	CHURCH HILL.					
130412	H. E. Walls	G	99.52	0.16	0.32	
	John J. Buffington & Co.	F	99.32	0.39	0.29	1176
	CUMBERLAND.					
*130004	W. T. Coulehan & Bro.	G	96.26	0.97	2.77	
	John J. Buffington & Co.	F	96.49	0.50	3.01	12096
130005	W. T. Coulehan & Bro.	G	99.03	0.94	0.03	
	John J. Buffington & Co.	F	99.60	0.37	0.03	336
130319	Flintstone Hardware Co.	G	98.41	----	0.50	
	Wm. G. Scarlett & Co.	F	98.97	0.73	0.30	2912
	EAST NEW MARKET.					
130476	C. H. Willis	G	Unlabeled.			
		F	98.53	0.82	0.55	3080
	ELKTON.					
130389	R. B. Frazer	G	Unlabeled.			
		F	98.89	0.85	0.26	1176
	FEDERALSBURG.					
130486	Covey & Williams	G	Unlabeled.			
		F	99.55	0.33	0.12	504
130483	Holt & Hyland	G	99.10	----	0.10	
	Wm. G. Scarlett & Co.	F	99.12	0.54	0.35	448
130489	O. G. Williamson	G	Unlabeled.			
		F	96.30	1.28	2.42	7112
	FREDERICK.					
130650	P. L. Hargett & Co.	G	Unlabeled.			
		F	93.17	2.21	4.62	20720
130635	A. G. Quynn & Co.	G	Unlabeled.			
		F	98.33	0.86	0.81	2352

*Hungarian.

GERMAN MILLET—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight			Approximate No. of Foreign Seeds per lb.
			Pure Seed	Inert Matter	Foreign Seed	
	HAGERSTOWN.					
*130621	Emmert Hardware Co.	G	96.57	0.64	2.79	
	John J. Buffington & Co.	F	96.56	0.78	2.66	11088
	HILLSBORO.					
130424	Stewart & Jarrell	G	Unlabeled.			
		F	96.65	0.55	2.80	21448
	LESLIE.					
130392	C. A. Benjamin & Co.	G	Unlabeled.			
	W. A. Simpson & Co.	F	99.11	0.86	0.01	56
	POCOMOKE.					
130546	Lloyd & Blaine	G	99.49	----	0.26	
	Wm. G. Scarlett & Co.	F	98.50	0.88	0.62	3752
130525	Peninsula Produce Exchange of Maryland	G	Unlabeled.			
		F	99.14	0.40	0.46	1792
130522	W. S. Schoolfield Co.	G	Unlabeled.			
	W. A. Simpson & Co.	F	99.23	0.32	0.45	1344
	PORT DEPOSIT.					
130398	J. M. Campbell & Co.	G	99.03	0.24	0.73	
	John J. Buffington & Co.	F	98.62	0.36	1.02	4536
	PRINCESS ANNE.					
130548	C. H. Hayman					
	Wm. G. Scarlett & Co.	G	98.40	----	0.20	
		F	98.70	1.12	0.18	1680
	PRESTON.					
130453	Garris & Covey	G	Unlabeled.			
		F	98.53	1.11	0.36	2352
	QUEEN ANNE.					
130422	G. L. Jump	G	Unlabeled.			
		F	98.89	0.68	0.43	2688
	RIDGELY.					
130429	J. W. Simons	G	Unlabeled.			
		F	98.35	0.65	1.00	8400
	SALISBURY.					
130500	Dorman & Smyth Hardware Co.	G	98.66	0.98	0.50	
	Wm. G. Scarlett & Co.	F	98.76	0.72	0.52	2800

GERMAN MILLET—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Percentage by Weight.				Approximate No. of Foreign Seeds per lb.
		Given. Found.	Pure Seed.	Inert Matter.	Foreign Seed.	
	SNOW HILL.					
130518	Hastings & Timmons	G	97.08	0.57	2.35	
	John J. Buffington & Co.	F	97.28	0.55	2.17	12600
130515	Thos. P. Selby	G	Unlabeled.			
		F	99.41	0.27	0.32	784
130521	C. S. Timmons	G	99.03	0.24	0.73	
	John J. Buffington & Co.	F	98.17	0.40	1.43	6272
	VIENNA.					
130459	George W. Millard	G	Unlabeled.			
		F	98.52	0.80	0.68	4088

ORCHARD GRASS.

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Percentage by Weight.				Approximate No. of Weed Seeds per lb.
		Given / Found	Pure Seed	Inert Matter	Foreign Seed	
	ANNAPOLIS.					
130313	Henry B. Myers Co.	G	63.95	----	----	
	W. A. Simpson & Co.	F	69.57	29.17	1.26	3130 A2*
	BALTIMORE.					
130111	J. Bolgiano & Son	G	81.83	16.67	1.50	
		F	72.61	26.01	1.38	6040
130122	" "	G	82.46	15.78	1.76	
		F	76.77	19.10	4.13	67648
130349	" "	G	31.36	64.73	3.91	
		F	44.05	52.65	3.30	32544
130594	" "	G	Unlabeled.			
		F	53.30	45.70	1.00	4972
130208	John J. Buffington & Co.	G	80.07	14.46	5.47	
		F	74.68	19.11	6.21	74128 A2
130209	" " "	G	85.19	13.97	0.84	
		F	82.75	16.60	0.65	5424
130328	" " "	G	80.93	18.56	0.49	
		F	79.15	20.35	0.50	3390
130330	" " "	G	79.68	19.32	1.00	
		F	77.10	21.30	1.65	4068
130331	" " "	G	83.13	14.43	2.44	
		F	80.30	17.80	1.90	5424
130336	" " "	G	79.23	16.94	3.83	
		F	77.30	19.00	3.70	7232
130337	" " "	G	81.89	17.70	0.41	
		F	76.89	22.16	0.95	4292
130567	" " "	G	88.10	11.39	0.51	
		F	82.95	16.75	0.30	0
130568	" " "	G	81.63	15.92	2.45	
		F	73.42	22.51	4.07	82716 A2
130658	" " "	G	87.50	11.69	0.81	
		F	81.85	17.55	0.60	4520

*Average of two tests.

NOTE.—Our analyses of orchard grass samples were made some nine to twenty months after the samples were collected, evidently, therefore, even a longer time after the furnished analyses were obtained in the merchants' laboratories. It is claimed by one merchant that many of the orchard grass seeds will lose considerable moisture as time passes, hence will also lose much weight. This, apparently, would cause a decided readjustment of the weights of the pure seed and inert matter constituents of the sample, showing itself in an increase in the percentage of inert matter and a decrease in the percentage of pure seed. This matter will be investigated by the State Seed Laboratory; but at present the evidence at hand is considered insufficient to justify the non-publication of the results of our work.

ORCHARD GRASS—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Percentage by Weight.				Approximate No. of Weed Seeds per lb.
		Given / Found	Pure Seed	Inert Matter	Foreign Seed	
	Baltimore—(Continued).					
130659	John J. Buffington & Co.	G	76.34	22.07	1.59	
		F	66.02	31.02	2.96	27346 A2
130660	“ “ “	G	87.35	12.24	0.41	
		F	80.89	18.46	0.65	5876 A2
13095	Griffith & Turner Co.	G	Unlabeled.			
		F	81.87	17.58	0.55	2712
130180	Wm. G. Scarlett & Co.	G	85.79	13.20	1.01	
		F	84.10	14.75	1.15	678
130362	“ “ “	G	19.82	78.02	2.16	
		F	28.95	68.05	3.00	6328
130682	“ “ “	G	78.00	20.50	1.50	
		F	77.70	21.35	0.95	1356
130706	“ “ “	G	75.20	22.93	1.87	
		F	68.65	29.85	1.50	7684
130140	W. A. Simpson & Co.	G	84.56	13.87	1.57	
		F	79.60	18.55	1.85	2260
130156	“ “ “	G	43.35	56.36	0.29	
		F	33.45	66.05	0.50	4294
130187	Wiseman & Downs	G	Unlabeled.			
		F	73.55	21.55	4.90	96502
	BERLIN.					
130506	R. C. Peters & Sons	G	Unlabeled.			
		F	33.45	62.60	3.65	9040
	CAMBRIDGE.					
130295	Oliver Spedden	G	76.25	18.44	5.31	
	John J. Buffington & Co.	F	74.30	23.80	1.90	19436
	CUMBERLAND.					
130317	Flintstone Hardware Co.	G	69.90	7.21	----	
	Wm. G. Scarlett & Co.	F	68.54	27.86	3.60	48622
	EASTON.					
130268	Shannahan & Wrightson Hardware Co.	G	79.66	16.00	4.50	
	John J. Buffington & Co.	F	76.65	18.10	5.25	48138
130278	N. Tuthill & Son	G	79.20	19.19	1.61	
	John J. Buffington & Co.	F	75.25	21.35	3.40	35482
	FREDERICK.					
13072	P. Hargett & Co.	G	79.24	19.24	1.50	
	John J. Buffington & Co.	F	77.66	17.83	4.51	20340 A4*

*Average of 4 tests.

ORCHARD GRASS—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight.			Approximate No. of Weed Seeds per lb.
			Pure Seed	Inert Matter	Foreign Seed	
	Frederick—(Continued).					
130634	A. G. Quynn & Co.	G	85.79	13.20	1.01	
	Wm. G. Scarlett & Co.	F	81.07	16.90	2.03	12533
	HAGERSTOWN.					
13026	Ernest W. Miller	G	78.80	21.14	0.06	
	W. H. Small & Co., Evansville, Ind.	F	72.15	26.70	1.15	226
	POCOMOKE.					
130544	Lloyd & Blaine	G	Unlabeled.			
		F	38.60	59.60	1.80	7232
130531	Peninsula Produce Exchange of Maryland	G	Unlabeled.			
		F	81.18	15.46	3.36	6040
	SALISBURY.					
130287	Dorman & Smyth Hardware Co.	G	Unlabeled.			
	W. A. Simpson & Co.	F	76.75	22.00	1.25	2486

REDTOP.

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight. Pure Seed	Percentage by Weight. Inert Matter	Percentage by Weight. Foreign Seed	Approximate No. of Weed Seeds per lb.
	ANNAPOLIS.					
130309	Henry B. Myers Co. W. A. Simpson & Co.	G	83.20	----	----	
		F	84.44	9.58	5.98	32616
	BALTIMORE.					
130113	J. Bolgiano & Son	G	93.02	6.79	0.19	
		F	94.00	5.80	0.20	35334
130128	“ “	G	67.68	24.80	7.52	
		F	74.40	17.60	6.00	70668
130350	“ “	G	91.62	7.80	0.58	
		F	91.52	8.46	0.02	10872
130196	John J. Buffington & Co.	G	83.90	9.32	6.78	
		F	84.34	10.84	4.82	34428
130197	“ “ “	G	80.83	15.84	3.33	
		F	79.86	18.12	2.02	906
130198	“ “ “	G	92.11	7.25	0.64	
		F	95.41	4.19	0.40	50736 A2*
130569	“ “ “	G	94.89	4.09	1.02	
		F	93.98	5.32	0.70	3624
13096	Griffith & Turner Co.	G	93.00	----	----	
		F	95.92	3.56	0.52	7248
130108	Meyer-Stisser Co.	G	Unlabeled.			
		F	92.84	6.78	0.38	2718
130184	Wm, G. Scarlett & Co.	G	91.50	4.50	4.00	
		F	89.94	7.54	2.52	1812
130678	“ “	G	95.59	3.92	0.49	
		F	93.59	6.29	0.12	16308 A2
130701	“ “	G	90.10	8.91	0.99	
		F	89.76	9.96	0.28	9060
130139	W. A. Simpson & Co.	G	68.11	12.70	19.19	
		F	37.58	59.41	3.01	16308 A2
130147	“ “ “	G	69.61	13.56	16.83	
		F	74.55	12.31	13.14	47112 A2
130158	“ “ “	G	90.00	----	----	
		F	89.90	8.68	1.42	9966
130376	“ “ “	G	Unlabeled.			
		F	18.22	75.54	6.24	15402
130382	“ “ “	G	Unlabeled.			
		F	63.38	14.38	22.24	61608
130575	“ “ “	G	Unlabeled.			
		F	90.42	8.34	1.24	15402

*Average of two tests.

REDTOP—(Continued).

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.		Percentage by Weight.			Approximate No. of Weed Seeds per lb.
		Given / Found	Pure Seed	Inert Matter	Foreign Seed	
	BETTERTON.					
130222	Turner & Son	G	92.11	7.25	0.64	
	John J. Buffington & Co.	F	95.07	4.76	0.17	3624 A2
	CHESTERTOWN.					
130228	Davis & Satterfield	G	83.20	----	----	
	W. A. Simpson & Co.	F	83.40	9.28	7.32	33522
130408	Davis & Satterfield	G	Unlabeled.			
		F	82.04	11.42	6.54	16308
130235	R. F. Parks & Son	G	Unlabeled.			
	J. Bolgiano & Son	F	94.22	5.78	0.00	0
	CUMBERLAND.					
130599	W. T. Coulehan & Bro.	G	Unlabeled.			
	J. Bolgiano & Son	F	86.26	12.74	1.00	15402
130318	Flintstone Hardware Co.	G	91.50	1.50	4.50	
	Wm. G. Scarlett & Co.	F	89.88	7.44	2.68	7248
130615	Flintstone Hardware Co.	G	91.50	4.00	4.50	
	Wm. G. Scarlett & Co.	F	89.68	7.16	3.16	8154
	DENTON.					
130259	Nuttle Hardware Co.	G	Unlabeled.			
	Wm. G. Scarlett & Co.	F	89.70	7.84	2.46	3624
	EAST NEW MARKET.					
130481	Saxton & Parker	G	Unlabeled.			
		F	89.66	6.02	4.32	19026
	EASTON.					
130271	Shannahan & Wrightson Hardware Co.	G	Unlabeled.			
		F	83.64	13.50	2.86	4530
130279	N. Tuthill & Son	G	92.79	3.51	3.50	
	John J. Buffington & Co.	F	92.98	4.54	2.58	12684
	FREDERICK.					
130641	Thomas & Co.	G	80.83	15.84	3.33	
	John J. Buffington & Co.	F	80.78	16.38	2.84	3624
	POCOMOKE.					
130538	N. Davis & Sons	G	Unlabeled.			
		F	80.52	17.96	1.52	5436
130543	Lloyd & Blaine	G	66.00	----	22.00	
	Wm. G. Scarlett & Co.	F	67.04	15.04	17.92	33522
130528	Peninsula Produce Exchange	G	Unlabeled.			
		F	67.60	17.80	14.60	11778
	SNOW HILL.					
130517	Thos. P. Selby	G	Unlabeled.			
		F	85.64	12.02	2.34	6342
	STILL POND.					
130224	Wm. Medders & Co.	G	91.50	4.50	4.00	
		F	90.56	7.22	2.22	6342

DWARF ESSEX RAPE.

Laboratory No.	SOURCE OF SAMPLE. VENDOR AND MERCHANT.	Given / Found	Percentage by Weight			Kinds of Weeds Represented.	No. of tests made.
			Pure Seed	Inert Matter	Foreign Seed		
	BALTIMORE.						
130166	J. Bolgiano & Son	G	98.72	1.21	0.07		
		F	98.56	1.29	0.15	3	--
130345	" "	G	98.18	1.57	0.25		
		F	99.03	0.89	0.08	5	2
130207	John J. Buffington & Co.	G	99.50	0.45	0.05		
		F	99.58	0.25	0.17	7	2
130571	" " "	G	97.82	2.03	0.15		
		F	97.97	2.03	0.00	0	--
130178	Wm. G. Scarlett & Co.	G	99.27	0.70	0.03		
		F	99.19	0.81	0.00	0	--
130375	W. A. Simpson & Co.	G	Unlabeled.				
		F	99.79	0.12	0.09	3	--
	DENTON.						
130258	Nuttle Hardware Co.	G	Unlabeled.				
	Wm. G. Scarlett & Co.	F	99.63	0.36	0.01	1	--
	EAST NEW MARKET.						
130475	C. H. Willis	G	Unlabeled.				
		F	99.77	0.20	0.03	1	--
	POCOMOKE.						
130545	Lloyd & Blaine	G	99.27	----	0.03		
	Wm. G. Scarlett & Co.	F	99.37	0.61	0.02	1	--
	SALISBURY.						
130501	Dorman & Smyth Hardware Co.	G	97.73	----	----		
		F	99.20	0.63	0.17	5	--
130502	Farmers & Planters' Co.	G	Unlabeled.				
		F	99.70	0.19	0.11	1	--
	SNOW HILL.						
130513	G. M. Dryden	G	Unlabeled.				
		F	99.83	0.13	0.04	2	--
130516	Thos. P. Selby	G	Unlabeled.				
		F	99.14	0.82	0.04	2	--

LAWS OF MARYLAND—JANUARY SESSION, 1914.

CHAPTER No. 424.

AN ACT to repeal Chapter 810 of the Acts of the General Assembly of Maryland, passed at the January Session in the year 1912, entitled "An Act to add five additional Sections to Article 48 of the Code of Public General Laws 1904 (1904), title 'Inspections,' to be known as Sections 51-A, 51-B, 51-C, 51-D and 51-E, to provide for the examinations of seeds sold in the State of Maryland and to determine their purity," and to re-enact same with amendments by adding five additional Sections to Article 48 of the Code of Public Civil Laws (Bagby's Annotated Code), to follow Section 88 and to be known as Sections 89, 90, 91, 92, 93, 94 and 95, to provide for the examination of seeds sold in the State of Maryland, to determine their purity, to require labeling and to provide penalties for failure to comply with the conditions imposed by this Act.

SECTION 1. *Be it enacted by the General Assembly of Maryland,* That Chapter 810 of the Acts of the General Assembly of Maryland, passed at the January Session in the year 1912, entitled "An Act to add five additional Sections to Article 48 of the Code of Public General Laws (1904), title 'Inspections,' to be known as Sections 51-A. 51-B, 51-C, 51-D and 51-E, to provide for the examination of seeds sold in the State of Maryland, and to determine their purity," be repealed and re-enacted with amendments by adding seven additional Sections to Article 48 of the Code of Public Civil Laws (Bagby's Annotated Code), to follow Section 88 and to be known as Sections 89, 90, 91, 92, 93, 94 and 95 so as to read as follows:

(51-A) 89. The State Board of Agriculture shall be authorized to obtain samples of seeds sold or offered for sale within the State of Maryland, and shall cause the same to be examined and analyzed for the purpose of determining their purity and vitality, or any other facts affecting their value for seeding; and shall publish the results of such examination, together with the statement of purity of said seed as furnished by the vendor,together with the names and addresses of the persons, firms, companies, corporations or agents from whom such seeds were purchased, and the name or designation under which such seeds were sold, known or advertised for sale or use. Ten days before the publication of the results of the analysis of a sample which is below the standard represented a report shall be made to the vendor.

(51-B) 90. (That) all seeds hereinafter sold or offered for sale in lots of one bushel or more shall be labeled, said label to contain a statement (of the purity and kind of seed and the amount of foreign matter) plainly marked thereon giving the name of the seed, the approximate percentage of purity, of inert matter, and of foreign seed therein; each label shall also contain a statement plainly marked thereon giving the approximate percentage of germination, obtained by laboratory test, and the month and year when said test was made. One copy of said label shall be securely fastened upon the exterior of the bag or other receptacles containing the seed, and another copy of same shall be placed within said bag or other receptacle. Sections (51-A) 89 and (51-B) 90 shall not apply to seeds sold for food or manufacturing purposes, or to seeds marked "Uncleaned," or to lawn grass or pasture mixtures.

(51-C) 91. Any resident of Maryland desiring an analysis of seed may submit samples of the same to the State Board of Agriculture for the purpose hereinbefore mentioned; and if said samples are of seed purchased or sold, then the same shall be drawn from the whole quantity so purchased or sold at the time of actual delivery of said seed to the buyer, and shall be drawn in the presence of both the seller and the buyer or their representatives, and of a third person, and said samples shall be divided into three parts, one to be sent to the State Board of Agriculture for analysis, as hereinbefore mentioned, and the remaining two parts to be held, one each by the buyer and seller, to be available for all in the event of dispute as to the analysis.

92. A Seed Inspector and Analyst shall be appointed by the State Board of Agriculture and said Inspector or a deputy selected by him shall have authority to enter any store or warehouse, rooms or buildings, railroad stations or steamboat wharves, where seed may be offered for sale, stored, waylaid in transit, or held for delivery, for the purpose of enabling said officer to inspect the labeling, collect samples for analysis, and obtain any other information needed for the work of the Inspector and Analyst. It shall be the duty of the Inspector to pay the owner, or his agent, on demand, on a basis not exceeding the local market rates for all samples taken.

93. Any merchant or vendor violating the provisions of Section 90, and any person interfering with the work of the Seed Inspector as provided for in Section 92, shall be guilty of a misdemeanor, and upon conviction in any Court of competent jurisdiction, shall be fined not more than fifty dollars ($50) for each offense.

94. For carrying out the provisions of this Act, the sum of three thousand dollars for the year 1915, and the sum of three thousand dollars for the year 1916, is hereby appropriated from any money in the treasury not otherwise appropriated .

(51-E) 95. All Acts or parts of Acts inconsistent with this Act are hereby repealed.

Sec. 2. *And be it enacted,* That this Act shall take effect October 1st, 1914.

Approved April 10th, 1914.

THE GREAT SEAL
OF
MARYLAND.

P. L. Goldsborough,
Governor.
Jesse D. Price,
President of the Senate.
Jas. McC. Trippe,
Speaker of the House of Delegates.

OFFICIAL NOTICE TO SEED DEALERS No. 2

Seed merchants, commission merchants, hardware and elevator firms, grocers, general stores and any other firs or persons who may ship or sell seeds within the State of Maryland are hereby notified that the State seed inspection service will expect to find all agricultural seeds, sold* or on sale for seeding purposes, labeled as set forth in the following classification:

NAME, PURITY AND GERMINATION TESTS REQUIRED.

All clovers, trefoils and alfalfa, vetches and rape, orchard grass, Bluegrass, redtop, the various millets, sorghams and Sudan grass and winter oats.

NAME AND GERMINATION TEST ONLY REQUIRED.

All varieties of corn, cow peas and soy (soja) beans, field and garden peas and beans.

A limited number of samples of spring oats, buckwheat, rye and wheat will be collected for experimental purity and germination tests; but we do not feel justified, at the present time, in applying the law to the seed of these crops.

This notice is effective at once and will remain in force until modified by subsequent official notice.

(Signed) C. P. SMITH,

January 15, 1915. *Seed Inspector.*

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*The word "sold," as used above and in the law, is here interpreted to apply to any purchased lot of seed during the time that said lot is in transit, or held for delivery to a carrier, the buyer, or a representative of either.

THE MARYLAND AGRICULTURAL
EXPERIMENT STATION

BULLETIN 190. FEBRUARY, 1915.

TESTS OF VARIETIES OF CORN.

By W. E. Hanger.

Introduction.

Corn is distinctively an American crop. Nowhere in the records of any country is anything mentioned regarding this crop until after the first explorations were made into the New World. From all that has been found out, we are led to believe that its original home was in the semi-tropical regions of Mexico.

It is likely that the original type of corn was what is now known as pod corn, a corn having each grain on the ear enclosed in a separate husk. From this type as a beginning there have evolved several distinct types, which are known as dent corn (the most common type in Maryland), flint corn, pop corn, sweet corn and soft corn.

It seems that since a very early period corn has held the place of most importance in the agricultural industry of this country, and from early records of Maryland we know that corn has always been king in this State, as elsewhere. According to the 1910 census reports there are about 650,000 acres of corn grown in this State. There is practically the same acreage of wheat, but since corn has an average value of $22.50 per acre, and wheat only $13.50, the total value of the corn crop exceeds that of wheat by $6,000,000 in Maryland alone.

The average yield of corn in this State is about 34 bushels per acre, which is very good when compared with the average of the United States, but decidedly lower than it should be. There are several ways to increase the yield of this important crop. The most effective way of accomplishing this end is to increase the fertility of the land. However, after employing good methods to improve the fertility of the land, much progress may be made by growing just those varieties that are particularly adapted to local conditions. It has been pretty well established that varieties must become acclimated before they will give the best results; hence it is usually bad practice to secure seed corn produced under widely different climatic conditions. In order to determine which varieties are best adapted to the State, the Experiment Station has tested 75 varieties or strains of corn since the year 1903, either at College Park or in cooperation with farmers in various parts of the State.

Variation in Varieties of Corn.

Varieties of corn vary widely in many respects. Some will mature in from 60 to 90 days, while others require 120 or even 150 days. Variation in the appearance of ears and fodder is almost as striking as the variation in length of time required for maturity. While corn that matures in a very short season is small-eared, and has fodder not more than four or five feet, or even less, in height, that requiring a long period to mature has very large fodder, grows from 15 to 20 feet in height, and has from two to six ears to the stalk. There are two distinct types if large corn, the type bearing one very large ear. and the type bearing more than one fairly large ear with often several smaller ones. The latter is commonly spoken of as prolific corn.

The variation in color of grain is also quite marked. There are ears of bright yellow, pale yellow, white, white capped, red, blue and calico. Usually the yellow corn has red cobs, and the white corn white cobs, but there are some varieties of white corn with red cobs. It is, indeed, very fortunate that such a wide variation occurs in the varieties of corn, for within the boundaries of almost any State there is considerable difference in climate according to latitude and elevation. In this State we have quite a difference in the length of the growing season between Southern Maryland and the Mountain Section. We might divide the State roughly into three great divisions, according to length of season, viz., very long season, Southern Maryland and the Eastern Shore: medium season, Piedmont Section; very short season, Mountain Section. *Southern Maryland and the Eastern Shore* would include Kent, Queen Anne, Talbot, Caroline, Dorchester, Wicomico, Somerset, Worcester, Anne Arundel, Prince George's. Charles, St. Mary's and Calvert Counties; the *Piedmont Section* would include Cecil, Harford, Carroll, Baltimore, Howard, Montgomery, Frederick and Washington Counties; and the *Mountain Section* would include Allegany and Garrett Counties. It is evident, then, that the same varieties of corn that are well adapted to one of these sections are not well adapted to the others.

To learn just which varieties and types will give the best results is the main object of conducting variety tests of corn. Since there is quite a good deal of variation in the season from one year to another, even in the same locality, too much stress cannot be laid upon the results of a single year's work; in fact, it is not safe to base conclusions upon anything short of a five-year test. If, however, one variety or strain gives consistently high yields over a five-year period, it would seem safe to recommend that variety as being well adapted.

In order to determine which varieties are best suited to the various parts of the State, it becomes quite necessary to conduct these variety tests in all sections, and, in accordance with this idea, a number of such tests have been carried on at various places for a period of several years.

METHODS USED IN VARIETY TESTING.

The first thing to consider when starting a variety test is the character of the soil on which the test is to be made. In this part of the country it is very difficult to find a piece of land of any considerable size that possesses much uniformity of soil composition or fertility. Of course, the object of a variety test should be to determine which of several varieties gives the best results, hence it is quite important that all the varieties in test be given exactly the same treatment and opportunities. The land used should be as uniform in fertility as possible. The size and number of the plots should be such that only that amount of land will be required which can be plowed in one day, and all subsequent workings should be given to all plots alike. In order to keep the condition of fertility as nearly uniform as possible, it is always best to plow the land, prepare the seed-bed, and apply fertilizer at right angles to the long way of the plots. By doing this the danger of giving one plot a different treatment from another is greatly eliminated. When one part of the field is cultivated it should all be cultivated; thereby, any factors which would have an influence on the yield may be eliminated, and the only differentiation be that occurring in the varieties themselves.

From the foregoing statements it is evident that all the varieties are to be grown close together, hence there will naturally be cross-pollination and a mixing of the varieties. While this is true, it is not generally believed that the yield of that particular crop is materially affected, but it makes it necessary to secure seed each year from the original source. It is also quite important that the seed be equally good for all varieties, and to be sure of this, all ears used for the test should be tested for germination. A poor stand of corn is often responsible for low yield, hence the importance of a perfect stand of each variety. As a further precaution, and as a check upon the fertility of the land, one variety should be planted at regular intervals and the yield determined. Other things being equal, two plots of the same variety on land of equal fertility should give practically the same yield.

For several years it has been our custom at the Experiment Station to use check plots every fifth plot, with no duplication of varieties. However, this method has not always proven satisfactory, and for the crop of 1912 the varieties were all duplicated and the average yield of two plots taken to represent one variety. This has seemed to give better results, and in the spring of 1913 the plots were made smaller and run in triplicate, checks still being used, but at longer intervals.

It is now generally conceded by all investigators that more accurate results may be obtained by having comparatively small plots, and having them repeated several times than by the use of larger plots used only once. While this method can be used very nicely at Experiment Stations, it is hardly practicable to carry out in cooperation with the farmer, and for such tests plots the entire length of the field and four rows wide are a very convenient size. These require just one round with the planter, and are wide enough to keep separate very conveniently at cutting time.

To secure a better idea of the effect of season upon the yield of the corn crop in general, one variety has been for many years used here for planting check plots. The same variety is also used whenever possible for tests conducted over the State.

Calculating Yields of Corn.

Since there exists the variation spoken of in the size of the ear and cob, it follows that at the time of husking some varieties will have dried out a good deal more than others, and hence the moisture content will be quite different. It would be manifestly unfair, then, to take the actual weight of corn at the time of husking to represent the yield of an early variety in comparison with that of a late variety. It is evident that before we can compare the yields they must be reduced to the same moisture basis. Usually, varieties of corn will contain from 20 to 25 per cent. of moisture in the shelled corn at husking time (about November 15th), and there will be quite a wide variation in the moisture content of the cobs.

The actual weight of each variety is determined at the time of husking by weighing all the corn in the field, an accurate count made of the merchantable and unmerchantable ears, and the weight of each determined separately. From each plot is taken a moisture sample of about 50 pounds, which is placed in a sack, properly labeled inside and outside, and stored away in the seed barn until a convenient time for making the moisture determinations. Later, the weight of the fodder is taken, and for this purpose it has been found most convenient to use a 300-pound spring balance suspended from the end of a long lever, which is atached to a derrick that is mounted on a sled so that it can easily be moved from one plot to another. Moisture samples should also be obtained of the fodder, but this has not always been done in all our tests.

The moisture samples of the corn are allowed to hang in the barn until the rush of the fall season is over, when they are taken down, weighed and shelled. Before shelling, each ear is carefully measured. The following data is obtained and tabulated on specially prepared tally sheets, as follows: Length of Ear, Number of Rows, Depth of Grain, Circumference at Butt, Circumference at Tip, and Weight of Ear. From this data it is possible to secure very accurate information regarding any variety of corn. We may learn whether there exists any correlation between the ear characters named and the yield. For instance, from data secured for the crops of 1912, 1913 and 1914, there seems to be some correlation between yield and length of ear.

From the shelled corn a sample is taken, and moisture determination made with the Brown-Duvel Moisture Tester. Moisture determinations of the cobs from each variety are also made on the same machine. Then, from the loss in weight of the 50-pound sample from husking time to testing time, and the actual moisture contained in the corn, the total amount of moisture that the corn contained at the time it was weighed is calculated. From data thus secured the per cent. of shelled corn and the actual amount of dry matter in the shelled corn of each variety is determined, 15 per cent. being allowed as the standard for air-dry corn. On this basis all yields are determined.

To determine the actual percentage of shelled corn we must take into consideration the moisture content of the cobs, because it is unfair to weigh up a lot more water in the cobs of some varieties than in others. In the tables of this bulletin only the results of the tests conducted at the Experiment Station farm have been calculated in the manner just described. When a variety test has been carried on in cooperation with a farmer, only the actual yields at the time of husking have been secured.

In order to emphasize the importance of reducing all yields to a uniform moisture basis, the following table was constructed, taking thirteen of the varieties tested at the Experiment Station in 1914 as an illustration. It will be noticed that not always the variety producing the greatest number of pounds in the field at husking time yields the greatest number of bushels of shelled corn per acre, and the idea is to grow corn, and not cobs. From a study of this table it can be seen that the final yield of a variety depends first, upon the total moisture content, and secondly upon the percentage of shelled corn. In the first column is given the number of bushels of ear corn per acre, using the field weight and counting 70 pounds per bushel. In the second column is given the total amount of moisture contained in the corn at that time. Next is given the bushels of ear corn when reduced to a moisture basis of 15 per cent., or what is commonly allowed for air-dry corn. We then see the actual percentage of shelled corn as calculated from amount of dry matter in the shelled corn and cobs, from which is calculated the bushels of shelled corn with 15 per cent. moisture, allowing 56 pounds per bushel.

Table I.

Showing bushels of ear corn per acre at husking time, total percentage of moisture at husking time, bushels of ear corn containing 15 per cent. moisture, allowing 70 lbs. per bushel, percentage of shelled corn, and bushels of shelled corn with 15 per cent. moisture, allowing 56 lbs. per bushel.

	Bus. Ear Corn Husking Time	Total % Moisture	Bus. Ear Corn 15%. Moisture	% Shelled Corn	Bus. Shelled Corn 15% Moisture
Thomas.......	59.82	30.7	48.77	78.8	48.08
Skipper	57.00	30.9	46.31	82.9	48.00
West. Md. W. C.	53.76	27.2	46.04	83.0	47.82
Boone Co. Wh.	53.14	27.4	45.39	82.0	46.52
Roslyn Dent...	50.02	23 5	45.03	81.8	46.07
Brandenburg..	53.48	26.2	46 43	79.2	46.01
U. S. No. 182..	53.27	30.7	43.40	83.1	45.08
Funk's Yel. D't	52.51	29.9	43.29	83.0	44.92
Excelsior......	50 39	29.0	42 08	83.2	43.78
Munikhuysen..	50.64	31.3	40.94	83.5	42.73
Leaming ...	50.39	30.1	41.46	81.5	42.25
Giant Beauty..	48.64	33.5	38.03	82.3	39 16
Cocke's Prolific	43.22	34.8	33.16	77.5	32.15

Yields of Varieties Tested.

In the following tables will be found the yields of the varieties tested at the Experiment Station, and at various places in the State in cooperation with farmers since 1903. The yields of both grain and fodder are given when the work has been carried on at the Experiment Station, but where it has been done out in the State, conditions were not practicable to determine the yield of fodder.

The tables do not include a complete list of varieties tested because not much value can be placed upon a test unless conducted for more than one year; consequently, those varieties that were in test at only one place for a single year have usually been omitted. It will also be noticed in the table of data that in no case has the source of the seed or any description of the variety been included; this information, however, is given rather in detail in the section of this bulletin devoted to a description of varieties.

TABLE II.

Yields of Varieties of Corn Tested in Cooperation with Farmers in Different Sections of the State.

(Yield in Bushels per Acre.)

1907

VARIETY	W. O. Collier Talbot County	Edward Choates Baltimore County	G. M. Campbell Harford County
Excelsior	48.00	68.04	51.51
Munkhuysen	44.10	77.44	54.93
U. S. P. B. No. 77	43.90	......	55.74
Royston	42.80	......	56.01
Boone County Wh.	41.00	......	54.39
Leaming	33.30	......	54.70

1908

VARIETY	W. O. Collier Talbot County	G. M. Campbell Cecil County	Edw. Choates Baltimore Co.	C. E. Bryan Harford County	W. B. Harris Kent County
Munikhuysen	48.69	51.75	77.52	78.93	34.98
Boone Co. Wht.	46.72	57.91	......	78.60	40.15
Round Top	46.02	......	......	64.42	......
Excelsior	45.47	55.87	71.76	75 49	31.17
St. Omer	42.92	......	83 28	80.24	......
Royston	42.58	56.74	......	67.57	......
Leaming	37.21	38.94	66.44	66.12	28.60
Campbell	......	63.50	......	73.72	......

1909

VARIETY	T. F. Houch Frederick County	W. B. Harris Kent County	Wm. Cooper Wicomico County	M. E. Walsh Carroll County	W. O. Collier Talbot County	Average for all Counties
Royston	52.90	38.57	58.79	86.65	52.29	57.84
St. Omer	38.72	39.14	64.04	65.35	76.55	56.76
Round Top	45.74	38.03	61.32	72.95	63.52	56.31
Excelsior	45.43	35.45	52.87	65.85	68.46	53 41
B'ne Co. Wht.	38.74	38.71	58.04	70.65	58.87	53.00
Thomas	51.08	39.36	......	75.45	45.86	52.93
Kemp	44.33	41.01	......	73.75	51.83	52.73
Leaming	46.13	34.18	......	71.15	50.49	50.49
Munikhuysen	35.05	37.85	48.24	62.75	67.62	50.30
Campbell	47.10	......	......	76.85	......	......
W. M. Wht. C	41.52	......	......	60.55	......	......
U.S.P. B. 77.	......	......	......	58.85	66.80	......

TABLE II—(Continued).

VARIETY	Wm. Gilbert, Harford County	
	1910	1911
Skipper	......	79.80
Brandenburg	......	77.10
Springwood Yellow	......	76.20
Giant Beauty	......	71.80
Thomas	55.36	86.80
Cloud's Early Dent	62.94	76.80
Excelsior	49.16	68.70
Boone County White	50.54	66.50
Leaming	51.22	64.80
Munikhuysen	54.68	......
St. Omer	53.99	......
Royston	53.28	......
Western Maryland Wht. Cap	51.91	......
Round Top	50.04	......

VARIETY	1913			
	Browning Baker Queen Anne County		Mont. County High Sch. Montgomery County	
	Yield	Rank	Yield	Rank
Boone County White	41.81	1	53.70	7
Giant Beauty	40.44	2	58.10	4
Thomas	39.95	3	53.50	8
Brandenburg	39.60	4	......	.
Excelsior	39.52	5	60.90	2
Royston	38.61	6	48.00	10
Skipper	36.50	7	63.50	1
Mammoth Yellow	36.49	8	60.84	3
Munikhuysen	33.76	9	57.50	6
Leaming	33.67	10	49.00	9
West. Md. White Cap	28.91	11	39.50	12
Springwood Yellow	......	..	44.17	11
Roslyn Dent	......	..	58.00	5

TABLE III.

Yields of Varieties of Corn Tested at Maryland Agricultural Experiment Station from 1903 to 1907.

VARIETY.	Yield of Grain (Bus. of Ear Corn per Acre)						Yield of Fodder (Lbs. per Acre)					
	1903	1904	1905	1906	1907	Ave.	1903	1904	1905	1906	1907	Ave.
St. Omer	......	64.22	69.91	61.13	86.18	70.36	.....	4506	4811	3771	4495	4396
Munikhuysen	......	......	66 18	61.59	74.05	67 27	.....	......	4397	3645	4015	4019
Cocke's Prolific	40 87	62.32	70.17	65.02	76.90	63.05	2162	6349	7929	5058	6306	5561
Williams	......	......	68.36	60.95	56.42	61.91	......	......	5315	3565	3446	4109
Marlboro Prolific	......	......	59.69	58.01	59.07	58.91	......	......	6207	4334	4918	5153
U. S. P. B. No. 77	39.93	66.44	62 91	59.12	66.12	58.90	3832	4729	4861	3276	2451	3629
Md. Yellow Dent	......	62.86	68 99	41.96	......	57.93	......	5177	4271	2352	......	3933
Boone Co. White (Ind)	35.56	67.26	58.70	60.91	65.65	57.61	1858	4209	4092	4117	4245	3607
Boone Co. Wht. (Spec.)	......	55.33	60.68	52.35	61.58	57.48	......	3911	3923	2914	3394	3535
Boone Co. Wht. (Tenn.)	42.03	69.95	61.92	55.29	46.85	55.21	2369	4254	4804	3853	3452	3746
Leaming	36.18	63.72	56 89	52.49	63.52	54.56	2129	3861	2735	2989	4068	3156
Mosby's Prolific	41.80	67.18	54.86	48.78	58.98	54.32	2358	8266	8506	5489	5189	5961
Sander's Imp.	40.95	58.05	59.12	59.11	52 87	54.02	2263	7284	8127	6244	5031	5789
West. Md. White Cap	......	52.28	61.45	47.01	......	53.58	......	3777	4166	3169	......	3704
Hickory King	42.55	......	59.54	44.95	64.39	52.86	2195	......	6093	5291	3383	4215
McMac. Gourd Seed	......	55.36	57.95	37.87	55.38	51.64	......	8251	7812	4043	4348	6113
Riley's Favorite	36.00	63.36	54.44	43.78	47.57	49.03	1797	3770	3261	2409	3154	2878
Reid's Yel. Dent	36.58	54 26	58.76	49.76	45.34	48.94	1733	3306	3192	2556	2955	2708
Ia Silvermine	40.24	51.08	50.41	39.56	44.91	45.24	2347	3117	3008	2344	2428	2648

TABLE IV.

Yields of Varieties of Corn Tested at Maryland Agricultural Experiment Station from 1908 to 1914.

Variety.	Bushels of Air-Dry Shelled Corn per Acre (15% Moisture.)								Pounds of Fodder per Acre.							
	1908	1909	1910	1911	1912	1913	1914	Ave.	1908	1909	1910	1911	1912	1913	1914	Ave.
U. S. P. B. No. 120		61.11	57.67					59.39		4686	2363					3524
St. Omer	46.40	66.68	64.84					59.31	3970	5183	2611					3921
U. S. P. B. No. 77	46.41	61.36	64.82					57.53	3428	4047	2257					3244
Cloud's Ey. Dent				54.62	59.52			57.07				2041				2041
Thomas	47.55	69.84	75.05	55.02	51.33	47.45	48.08	56.33	3220	4970	3108	3035		3140	4529	3667
Round Top	46.11	60.37	67.06		64.41	42.34		56.05	3776	4544	2895			3653		3692
Hildreth	34.61	66.28	64.43	58.66				55.99	5797	5112	3257	2704				4217
Kans. Sunflower	40.09	59.69	63.79	59.96				55.88	4029	3266	3054	2656				3251
Boone Co. White	41.46	61.36	63.64	57.03	63.91	48.52	46.52	54.63	3759	4260	3108	2190		3186	3869	3395
West Md. White Cap		63.05	61.87		66.81	31.68	47.82	54.28		4118	2238			2080	3816	3088
Munikhuysen	43.45	62.68	66.94	49.45	61.20	50.77	42.73	54.28	3116	4189	2931	2740		3586	3589	3152
Excelsior	42.89	64.80	66.56	52.63	62.43	42.75	43.78	53.69	3150	4757	3037	2613		3033	4113	3450
Skipper				52.69	73.27	41.45	48.00	53.71				2481		3080	3896	3152
U. S. No. 182					74.38	38.95	45.08	52.79						2373	3764	3068
Royston	40 90	50.30	70.32		64.14	37.92		52.71	2507	4544	2824			2766		3160
Brandenburg				57.48	56.52	49.33	46.01	52.43				2879		3206	4384	3489
Campbell	35.96	61.38	59.31					52.22	2634	5467	2834					3608
Springwood Yel			59.30	43.60		53.02		51.97			2452	1917		2493		2287
U. S. P. B. No. 100		50.64	52.38					51.51		3976	2424					3200
Legal Tender	36.94	53.55	61.25					50.58	4288	3195	4087					3856
Leaming	39.89	62.77	57.36	47.62	56.69	38.03	42.25	49.24	3022	3550	2345	2372		2433	3030	2792
Reid's Yel. Dent	44.76	52.63						48.69	3563	2130						2846
Cocke's Prolific						57.88	32.15	45.31						4526	5174	4850
Roslyn Dent						40.95	46.07	43.47						2653	3921	3287

DESCRIPTION OF VARIETIES.

Only those varieties are described in the following pages which have been or are now of considerable importance either in this State or other States.

It will be noticed that among the varieties described there are a number of Kansas corns, and the information regarding these varieties has been secured largely from Bulletin No. 193, of the Kansas Agricultural Experiment Station. A number of the varieties given in the tables, and not described, were secured from the United States Department of Agriculture, and were discarded after a few years' trial, either because they were not suited to conditions in this State, or because there was no breeder from whom to secure seed of the strain. Among these are the selections named U. S. P. B. No. 77, 100 and 120, Mosby's Prolific, Marloboro Prolific, Sander's Improved, Riley's Favorite and McMackins' Gourd Seed.

In the descriptions as given it may be noticed that the length of ear for some varieties is rather short. This is accounted for from the fact that the data for these descriptions was obtained largely from the crop of 1913, which was below normal because of the extremely dry season.

The illustrations accompanying the description of the varieties show typical ears, as nearly as could be selected. A careful study of the illustration will show the length, shape and diameter of the ear, and the depth and shape of the grain.

BOONE COUNTY WHITE.

Boone County White is a large white corn well adapted to a large part of this State. It usually makes a rank growth and bears good, heavy ears. The cob is medium sized, and since the grain is rather deep it usually shells out a good percentage of shelled corn. It requires a long growing season, as it does not often mature in less than from 125 to 135 days. The fodder will average nine to eleven feet in height.

In a crop of 64 bushels per acre of air-dry shelled corn the length of ear varies from five and one-half to eleven inches, about seven per cent of the ears being five and one-half to seven inches in length, 67 per cent. from seven and one-half to nine and one-half inches in length, and 26 per cent. from 10 to 11 inches in length. In a crop of 46 bushels the length of ear varies from five to ten and one-half inches, about eight per cent. being from five to six inches in length, 72 per cent. from six and one-half to eight and one-half inches in length, and twenty per cent. from nine to ten and one-half inches in length. About 70 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in length, 17 per cent. less than eight-sixteenths, and 13 per cent. more than nine-sixteenths. About 57 per cent. will have from 16 to 18 rows, seven per cent. less than 16, and 36 per cent. more than 18.

BRANDENBURG.

Brandenburg is a name given to a large yellow corn, which originated from Long's Prolific, and was brought into Frederick, Carroll and Howard Counties from the State of Pennsylvania. Breeding work was begun with this corn in 1905. At that time this corn was very coarse, and particularly lacking in uniformity, the ears being large and the grain loose upon the cob. Mr. Brandenburg conceived the idea of breeding and selecting this corn. so that he might develop a large-eared corn, with deep grain and solid cob. He selected rather tapering ears for his ideal, and in the course of a few years greatly modified the general type. The fodder is quite large, often growing 12 feet or more in height. It requires from 125 to 135 days to mature.

In a crop of 56 bushels per acre of air-dry shelled corn the length of ear varies from six to eleven and one-half inches, about six per cent. of the ears being six to seven inches in length, 52 per cent seven and one-half to nine and one-half inches in length, and 42 per cent. 10 to 11 and one-half inches in length. In a crop of 46 bushels the length of the ear varies from five to ten and one-half inches, about three per cent. of the ears being five to five and one-half inches in length, 78 per cent. six and one-half to eight and one-half inches in length, and nineteen per cent. nine to ten and one-half inches in length. About 56 per cent. will have from 16 to 18 rows, 15 per cent. having less than 16, and 29 per cent. more than 18. About 76 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in length, 20 per cent. having less than eight-sixteenths and four per cent. more than nine-sixteenths. The shelling percentage will run from 79 to 84.

COCKE'S PROLIFIC.

Cocke's Prolific is a tall-growing corn, bearing two or more ears to the stalk, and especially well adapted to the Southern States. The fodder often grows very tall, reaching a height of 15 to 18 feet. The ears are borne very high on the stalk, and when matured are very hard, almost flinty. It is a little too late in maturing for the average season in Maryland, requiring from 120 to 140 days or more to ripen, but it is well adapted for using in the silo, on account of the large yield of fodder.

In a crop of 58 bushels per acre of air-dry shelled corn the length of ear varies from four and one-half to ten and one-half inches, about

19 per cent. of the ears being from four and one-half to six and one-half inches in length, 58 per cent. from six and one-half to eight and one-half inches in length, and 23 per cent. from eight and one-half to ten and one-half inches in length. In a crop of 32 bushels the length of ear varies from four and one-half to ten and one-half inches, about 11 per cent. of the ears being from four and one-half to six inches in length, 74 per cent. from six and one-half to eight and one-half inches in length, and 15 per cent. from nine to ten and one-half inches in length. About 85 per cent. will have from ten to 12 rows, nine per cent. less than 10 and six per cent. more than 12. About 60 per cent. will have grain from six-sixteenths to seven-sixteenths inches in depth, 19 per cent. less than six-sixteenths, and 21 per cent. more than seven-sixteenths. The shelling percentage will run from 78 to 82.

Excelsior.

Excelsior is a white corn developed by W. Oscar Collier, Easton, Maryland. It is quite a rank-growing corn, the fodder getting very tall, and usually bearing the ears at considerable height. It requires from 120 to 130 days to mature. It has very much the appearance of Boone County White, and can scarcely be distinguished from it. It has a medium-sized cob, with deep kernels, and has always made a good showing in variety tests conducted at the Station and other places in the State. It is especially well adapted to Southern Maryland and the Eastern Shore. The fodder will average from nine to twelve feet in height.

In a crop of 62 bushels per acre of air-dry shelled corn the length of ear varies from five to eleven and one-half inches, about 13 per cent. being from five to seven inches in length, 73 per cent. from seven and one-half to nine and one-half inches in length, and 14 per cent. from 10 to 11 inches in length. In a crop of 43 bushels per acre the length of ear will vary from five to ten and one-half inches, about six per cent. being from five to six inches in length, 72 per cent. from six and one-half to eight and one-half inches in length, and 22 per cent. from nine to ten and one-half inches in length. About 56 per cent. will have from 16 to 18 rows, ten per cent. less than 16, and 34 per cent. more than 18. About 72 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in depth, 18 per cent. less than eight-sixteenths and ten per cent. more than nine-sixteenths. The shelling percentage will run from 82 to 84.

Funk's Yellow Dent.

Funk's Yellow Dent is a yellow corn very similar to Reid's Yellow Dent. The ear is quite cylindrical, with deep, closely set kernels. The cob is small and dark red. It grows rather vigorously, and produces a good yield under favorable conditions. It requires from 120 to 130 days to mature. It is not grown extensively in this State, but is increasing in popularity each year. It should be considered a very good variety for the State. The height of fodder will average about 10 feet.

In a crop of 45 bushels per acre of air-dry shelled corn the length of ear varies from five to ten and one-half inches, about eight per cent. of the ears being from five to six and one-half inches in length, 74 per cent. from six and one-half to eight and one-half inches in length, and 18 per cent. from eight and one-half to ten and one-half inches in length. About 55 per cent. will have from 18 to 20 rows, 25 per cent. less than 18, and 20 per cent. more than 20. About 62 per cent. will have grain from seven-sixteenths to eight-sixteenths inches in depth, 14 per cent. less than seven-sixteenths and 24 per cent. more than eight-sixteenths. The shelling percentage will run from 82 to 85.

GIANT BEAUTY.

Giant Beauty is a large-growing variety of yellow corn, which was developed by W. Oscar Collier, Easton, Talbot County, Maryland. The cob is rather large, but usually has a very deep grain. It requires from 125 to 135 days to mature. The ears are large and the fodder often grows to a height of 12 feet or more. It is well adapted to the lower counties of the Eastern Shore.

In a crop of 45 bushels per acre of air-dry shelled corn the length of ear varies from four and one-half to nine inches, about three per cent. of the ears being from four and one-half to six and one-half inches in length, 95 per cent. from six and one-half to eight and one-half inches in length, and two per cent. from eight and one-half to nine inches in length. About 62 per cent. will have from 18 to 20 rows, 18 per cent. less than 18, and 19 per cent. more than 20. About 79 per cent. will have grain from eight-sixteenths to nine sixteenths inches in depth, 18 per cent. less than eight-sixteenths and three per cent more than nine-sixteenths. The shelling percentage will average from 81 to 83.

HICKORY KING.

Hickory King is an eight-rowed white corn which was originated by A. O. Lee, Bartee, Virginia. A striking characteristic of this variety is the large proportion of kernel to the cob, the cob being very small and the kernel very broad. It has an unusually solid grain, and makes especially fine meal. It grows particularly well on light and sandy soils, and for this reason is probably more widely adapted than any other known variety.

HILDRETH.

Hildreth is a Kansas corn, and was first brought to the attention of the Kansas Experiment Station in 1902 by Mr. C. E. Hildreth, who had grown an exceptionally good crop that year. This corn has proven to be the largest yielder at the Kansas Station throughout the past several years under favorable conditions. The original seed contained many white cobs and red and calico ears were not infrequent, and the reddish tinge is still to be noticed in many ears.

It is a large yellow corn and matures late, requiring from 130 to 140 days. The ears are large, cylindrical or slightly tapering in shape, with deep, closely set kernels. It closely resembles a very large type of Ried's Yellow Dent. The number of rows ranges from 16 to 24. It is a heavy yielder on fertile soil in a favorable season.

IOWA SILVERMINE.

Silvermine corn was originatd by J. A. Beagley, Sibley, Illinois, about 1890. In 1895 the Iowa Seed Company bought Mr. Beagley's entire crop and renamed it the Iowa Silvermine. This is an early maturing variety of white corn, requiring from 105 to 115 days, and it has a wide adaptation. Because of the short season required for maturity, it is grown extensively throughout the Northern States of the Corn Belt. It is not a rank grower, and hence does not make as large yields as Boone County White or Collier's Excelsior.

The ears are medium in size, with small cobs and deep grain. It often has a shelling per cent. of close to 90. This corn is not grown to any extent in this State, but is undoubtedly well adapted to some sections of Western Maryland.

KANSAS SUNFLOWER.

Kansas Sunflower is one of the native varieties of Kansas. It was originated by John Moody, Eudoro, Kansas, about 1890, but it has been bred at the Kansas Experiment Station since 1903, and has been modified quite a little from the original type. It has always been a good producer of both corn and fodder in the State of Kansas.

This variety is a vigorous grower, requiring from 120 to 130 days to mature. It is much given to suckering. The color is very bright yellow. Ears are medium in size, cylindrical, with from 14 to 18 rows. The rows are straight, but inclined to be a little irregular at the butts and tips. Kansas Sunflower has never gained much of a foothold in this State.

LEAMING.

Leaming is a yellow corn originated by J. S. Leaming, of Ohio, in 1856. The original corn developed by Mr. Leaming was quite different from the type now grown in this State. Seed of Funk's Improved Leaming was secured from Funk Brothers, Bloomington, Illinois, in 1904, and has been bred by the Ear-to-Row method continuously since that time by the Experiment Station. The Improved Leaming grown in this State has a decidedly cylindrical ear, with a bright-yellow color, medium-sized dark red cob, medium-sized fodder, and matures in from 115 to 125 days. The average height of fodder is about seven and one-half to ten and one-half feet.

In a crop of 56 bushels per acre of air-dry shelled corn the length of ear varies from six to ten and one-half inches, about 21 per cent. of the ears being six to seven inches in length, 70 per cent. seven and one-half to nine and one-half inches in length, and nine per cent. ten to ten and one-half inches in length. In a crop of 38 bushels the length of ear varies from four and one-half to eleven inches, about 18 per cent. being from four and one-half to six and one-half inches in length, 65 per cent. from six and one-half to eight and one-half inches in length, and 17 per cent. eight and one-half to eleven inches in length. About 62 per cent. will have from 16 to 18 rows, 21 per cent. less than 16, and 19 per cent. more than 18. About 80 per cent. will have grain from seven-sixteenths to eight-sixteenths inches in depth, 17 per cent. less than seven-sixteenths and three per cent. more than eight-sixteenths. The shelling percentage will run from 82 to 86.

LEGAL TENDER.

Legal Tender corn was originated by Nimms Brothers, Emerson, Iowa, in 1876, by crossing two distinct types of yellow corn that differed quite a little, one having a short ear with from 20 to 24 rows of very deep kernels and the other a long ear with from 12 to 16 rows. It is a late-maturing corn, requiring from 125 to 135 days. It is a rank grower, thus making it suitable for silage corn. It is especially lacking in uniformity of size and shape of ear. It usually yields a heavy crop, but on account of its being large and late is not well suited to a large part of this State.

MUNIKHUYSEN.

Munikhuysen is a white corn. The seed of this variety was first obtained in 1903 from Mr. William Munikhuysen, of Thomas Run, Harford County, Maryland, who had been breeding it for several years previously. He had been selecting especially for well-filled butts and tips, and had largely succeeded in fixing that characteristic.

The Experiment Station has been carrying on breeding work with this corn by the Ear-to-Row method since 1903. It is a medium-sized corn, with fairly large cob and somewhat shallow, wide grain. Indentation is not very deep. It has proven to be a good producer in comparison with other varieties. It will mature in from 120 to 130 days, usually giving a high percentage of good, solid corn, and seems well adapted to a large section of the State. The fodder is medium to large in size, averaging eight and three-quarters to eleven feet in height.

In a crop of 61 bushels per acre of air-dry shelled corn the length of ear varies from six and one-half to 11 inches, about seven per cent. of the ears being six and one-half to seven inches in length, 80 per cent. from seven and one-half to nine and one-half inches in length, and 13 per cent. 10 to 11 inches in length. In a crop of 42 bushels per acre of air-dry shelled corn the length of ear varies from five to ten and one-half inches, about 20 per cent. of the ears being five to five and one-half inches in length, 68 per cent. from six and one-half to eight and one-half inches in length, and 12 per cent. nine to ten and one-half inches in length. About 60 per cent. will have from 14 to 16 rows, 11 per cent. less than 14, and 29 per cent. more than 16. About 74 per cent. will have grain from seven-sixteenths to eight-sixteenths inches in length, three per cent. less than seven-sixteenths and 22 per cent. more than eight-sixteenths. The shelling percentage will run from 83 to 85.

REID'S YELLOW DENT.

Reid's Yellow Dent is a yellow corn, which was originated by Robert Reid, Tazewell County, Illinois, in 1847. Mr. Reid obtained the variety by a natural cross between a large and rather late-maturing red corn known as Gordon Hopkins, and a rather early-maturing variety grown at that time quite generally in Tazewell County and known as Little Yellow.

It has been quite widely distributed, and on account of its firmly fixed type has been quite a favorite in corn shows over the country. It is more vigorous in growth than the Leaming, although it is an early-maturing variety, requiring from 115 to 125 days in this State. The color of grain is lemon yellow, and the cobs are a dark red. An objection sometimes raised is that on account of the extremely small shank a large number of ears are knocked off when harvesting with corn binders. It tapers at the tip, and has straight rows, which are very closely spaced. Although not grown extensively in this State, the variety should be considered one of the good varieties of yellow corn.

ROSLYN DENT.

Roslyn Dent is a local variety of yellow corn. It is not a highly-bred corn. It is a medium-sized early-maturing variety, requiring from 115 to 125 days. The cob is rather small, and the grain inclined to be narrow, so that it is common to find ears having from 22 to 26 rows. It has not proven to be a heavy producer at the Experiment Station during the two years it has been in test here. The fodder is of medium height, attaining an average of eight to ten feet.

In a crop of 41 bushels per acre of air-dry shelled corn the length of ear varies from four and one-half to eleven inches, about five per cent. of ears being four and one-half to six and one-half inches in length, 67 per cent. from six and one-half to eight and one-half inches in length, and 28 per cent. eight and one-half to 11 inches in length. About 58 per cent. will have from 16 to 18 rows, six per cent. less than 16, and 36 per cent. more than 18. About 81 per cent. will have grain from seven-sixteenths to eight-sixteenths inches in depth, eight per cent. less than seven-sixteenths, and 11 per cent. more than eight-sixteenths. The shelling percentage will run about 82.

Round Top.

Round Top is a yellow corn bred by W. Irving Walker, Chestertown, Maryland, since 1904. This is a medium-sized corn, both as to ears and fodder. It is usually a few days later in maturing than the Royston corn, which is bred by the same man. However, it will mature in from 120 to 130 days, and seems to be well adapted to Eastern Shore of Maryland. It is a rather smooth corn, with small cob and fairly deep kernel. The fodder will average eight and one-half to eleven feet in height.

In a crop of 64 bushels per acre of air-dry shelled corn the length of ear varies from six to eleven inches, about six per cent. of the ears being six to seven inches in length, 70 per cent. from seven and one-half to nine and one-half inches in length, and 24 per cent. from 10 to 11 inches in length. In a crop of 38 bushels the length of ear varies from six to ten and one-half inches in length, about 17 per cent. being from six to six and one-half inches in length, 55 per cent. from six and one-half to eight and one-half inches in length, and 28 per cent. from six and one-half to ten and one-half inches in length. About 63 per cent. will have from 14 to 16 rows, seven per cent. less than 14, and 30 per cent. more than 16. About 69 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in depth, 27 per cent. less than eight-sixteenths, and four per cent. more than nine-sixteenths. The shelling percentage will run from 80 to 85.

Royston.

Royston is a white cap corn developed by W. Irving Walker, Chestertown, Maryland. It has been bred by the Ear-to-Row method on his place since 1903, and has been very greatly modified and improved until it now possesses a good deal of type and uniformity. It bears well-matured ears, rather free from soft, unmerchantable corn. It has a medium-sized red cob, rather deep grain, fodder averaging eight and one-half to eleven feet in height, and matures in from 115 to 125 days.

In a crop of 64 bushels per acre of air-dry shelled corn the length of ear varies from five and one-half to twelve inches, about 10 per cent. of the ears being from five and one-half to seven inches in length, 67 per cent. from seven and one-half to nine and one-half inches in length, and 23 per cent. from ten to 12 inches in length. In a crop of 37 bushels the length of ear varies from five and one-half to eight and one-half inches, about 20 per cent. being from five and one-half to six and one-half inches in length, and 80 per cent. from six and one-half to eight and one-half inches in length. About 56 per cent. will have from 14 to 16 rows, seven per cent. less than 14, and 37 per cent. more than 16. About 64 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in length, 28 per cent. less than eight-sixteenths and 18 per cent. more than nine-sixteenths. The shelling percentage will run from 81 to 83.

Skipper.

Skipper is a bright yellow corn, which has been developed by H. P. Skipper, Chestertown, Maryland. It resembles the Leaming corn, but is larger and more vigorous in habit of growth, not being quite so uniform in size and shape of ear, and now and then producing a white cob. It is usually a better yielding corn than Leaming, and although larger it matures in about the same length of time, from 115 to 125 days being required. The fodder will average eight and one-quarter to ten feet in height.

In a crop of 73 bushels per acre of air-dry shelled corn the length of ear varies from four and one-half to ten and one-half inches, about 74 per cent. of the ears being seven and one-half to eight and one-half inches in length, five per cent. from four and one-half to six inches in length, and 19 per cent. from nine to ten and one-half inches in length. In a crop of 41 bushels the length of ear varies from four and one-half to ten and one-half inches, about 18 per cent. of the ears being four and one-half to six inches in length, 63 per cent. six and one-half to eight and one-half inches, and 19 per cent. nine to ten and one-half inches in length. About 59 per cent. will have from 16 to 18 rows, 21 per cent. less than 16, and 20 per cent. more than 18. About 67 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in length, 20 per cent. less than eight-sixteenths and 13 per cent. more than nine-sixteenths. The shelling percentage will run from 80 to 85.

ST. OMER.

St. Omer is a large variety of white corn grown for years in Harford County. Breeding work was begun with this corn in cooperation with Mr. Joseph T. Hoops, Bynum, Maryland, about 1903, and kept up for three or four years. Later, Mr. G. P. Radebaugh, also of Bynum, secured from Mr. Hoops the seed of this variety, and began growing and breeding it. Seed was secured from Mr. Radebaugh and put into variety test at the Experiment Station in 1907, and for the years 1907, 1908, 1909 and 1910 it was among the highest yielding varieties.

It is a little late in maturing, requiring from 125 to 135 days, but it made a good showing wherever tested. The prevailing number of rows was from 16 to 18, with ears from eight to nine and one-half inches in length. Unfortunately, this corn is no longer being bred or grown as such in this State.

THOMAS.

Thomas is a name given to a strain of the prevailing type of corn of Frederick County, is rather large-eared, yellow corn, that has been used for planting check plots at the Experiment Station since 1908. It does not show much refinement, is characterized by having a large cob, with only a fairly deep kernel, and could not be said to be highly bred corn. However, it has always proven to be a consistently high yielder wherever tested. The height of fodder of this corn will average eight and one-half to eleven feet, and it requires from 120 to 130 days to mature.

In a crop of 55 bushels per acre of air-dry shelled corn the length of ear varies from four and one-half to eleven and one-half inches, 20 per cent. of the ears being from four and one-half to six and one-half inches in length, 61 per cent. from six and one-half to eight and one-half inches in length, and 19 per cent. from eight and one-half to eleven and one-half inches in length. About 60 per cent. of the ears will have grain from seven-sixteenths to eight-sixteenths inches in depth, 18 per cent. less than seven-sixteenths, and 22 per cent. more than eight-sixteenths. About 57 per cent. will have from 16 to 18 rows, 17 per cent. less than 16, and 26 per cent. more than 18. The shelling percentage will run from 78 to 82.

U. S. 182.

U. S. 182 is a white corn bred by the United States Department of Agriculture. It is a first-generation cross, produced by crossing U. S. 119 and U. S. 120, the seed thus cross-pollinated being designated as First-Generation Cross No. 182. No. 119 was developed from Boone

County White, and No. 120 was developed from Hickory King. U. S. 182 is a medum-sized corn, the fodder growing from nine to ten feet in height under good conditions, and maturing in from 115 to 125 days. The ears are fairly large, the grains not deeply indented and rather wide. This corn has proven to be quite a good producer.

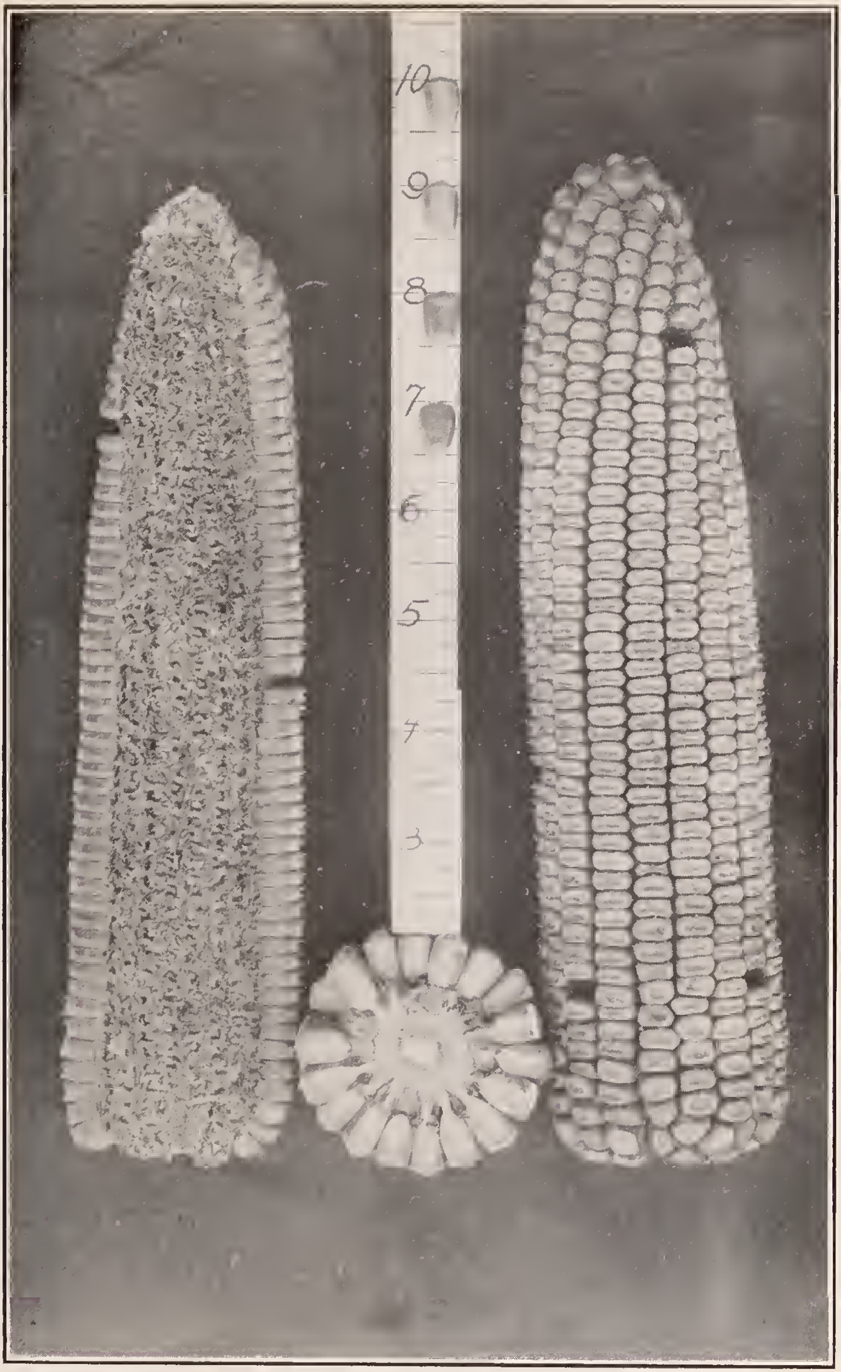
In a crop of 74 bushels per acre of air-dry shelled corn, the length of ear varies from six and one-half to eleven and one-half inches, about six per cent. of the ears being six and one-half to seven inches in length, 74 per cent. from seven and one-half to nine and one-half inches in length, and 20 per cent. from ten to eleven and one-half inches in length. In a crop of 39 bushels the length of ear varies from six to ten inches, about 10 per cent. being from six to six and one-half inches in length, 62 per cent. from six and one-half to eight and one-half inches in length, and 28 per cent. from nine to ten inches in length. About 60 per cent. will have from 14 to 16 rows, 20 per cent. less than 14, and 20 per cent. more than 16. About 76 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in length, 11 per cent. less than eight-sixteenths, and 13 per cent. more than nine-sixteenths. The shelling percentage will run from 83 to 85.

Western Maryland White-Cap.

Western Maryland White-Cap is a corn that has been grown in Frederick, Carroll, Howard and Harford Counties for many years, and has many local names. It has been grown here under the names of Schnabel, Lutgerding and Fenby, all three of these being the names of men who have been particularly interested in improving the variety. It is an early-maturing corn, not possessing much uniformity of type. However, in some sections of the State it produces large yields of solid corn.

Charles Willard Amos, Scarf, Harford County, Maryland, won first place in a Boys' Corn-Growing Contest in 1911, with this corn, growing 113-.6 bushels of air-dry shelled corn per acre. However, it does not seem to yield well when grown in other sections of the State. Since 1911 this corn has been bred by the Ear-to-Row method on the farm of F. P. Fenby, Woodensburg, Carroll County, Maryland, with the hope of securing greater uniformity and of fixing a more desirable type, but as yet very little progress is noticeable. The cob is rather large, the grain quite deep and the rows very irregular. The fodder is fairly heavy, attaining an average height of eight to ten feet. It matures in from 115 to 125 days, and the ears are given to tapering quite a little.

In a crop of 56 bushels per acre of air-dry shelled corn the length of ear varies from five and one-half to eleven inches, about 16 per cent. of the ears being five and one-half to seven inches in length, 67 per cent. seven and one-half to nine and one-half inches in length, and 17 per cent. ten to eleven inches in length. In a crop of 31 bushels the length of ear varies from five to ten inches, about 70 per cent. of the ears being six and one-half to eight and one-half inches in length, 24 per cent. less than six and one-half inches, and six per cent. more than eight and one-half inches. About 50 per cent. will have from 16 to 20 rows, 20 per cent. less than 16, and 30 per cent. more than 20. About 73 per cent. will have grain from eight-sixteenths to nine-sixteenths inches in length, 17 per cent. having less than eight-sixteenths and 10 per cent. more than nine-sixteenths. The shelling percentage will run from 83 to 85½.



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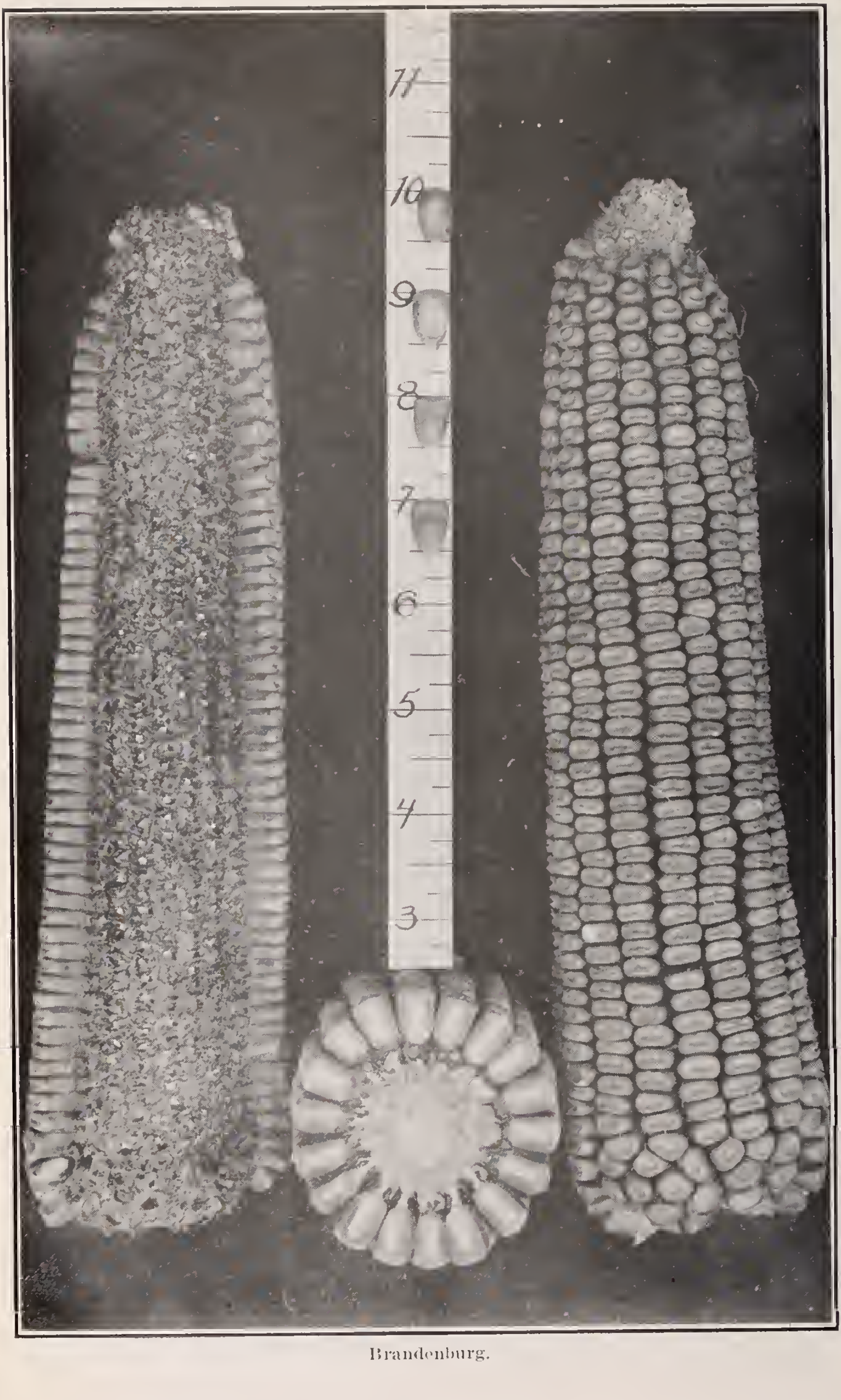

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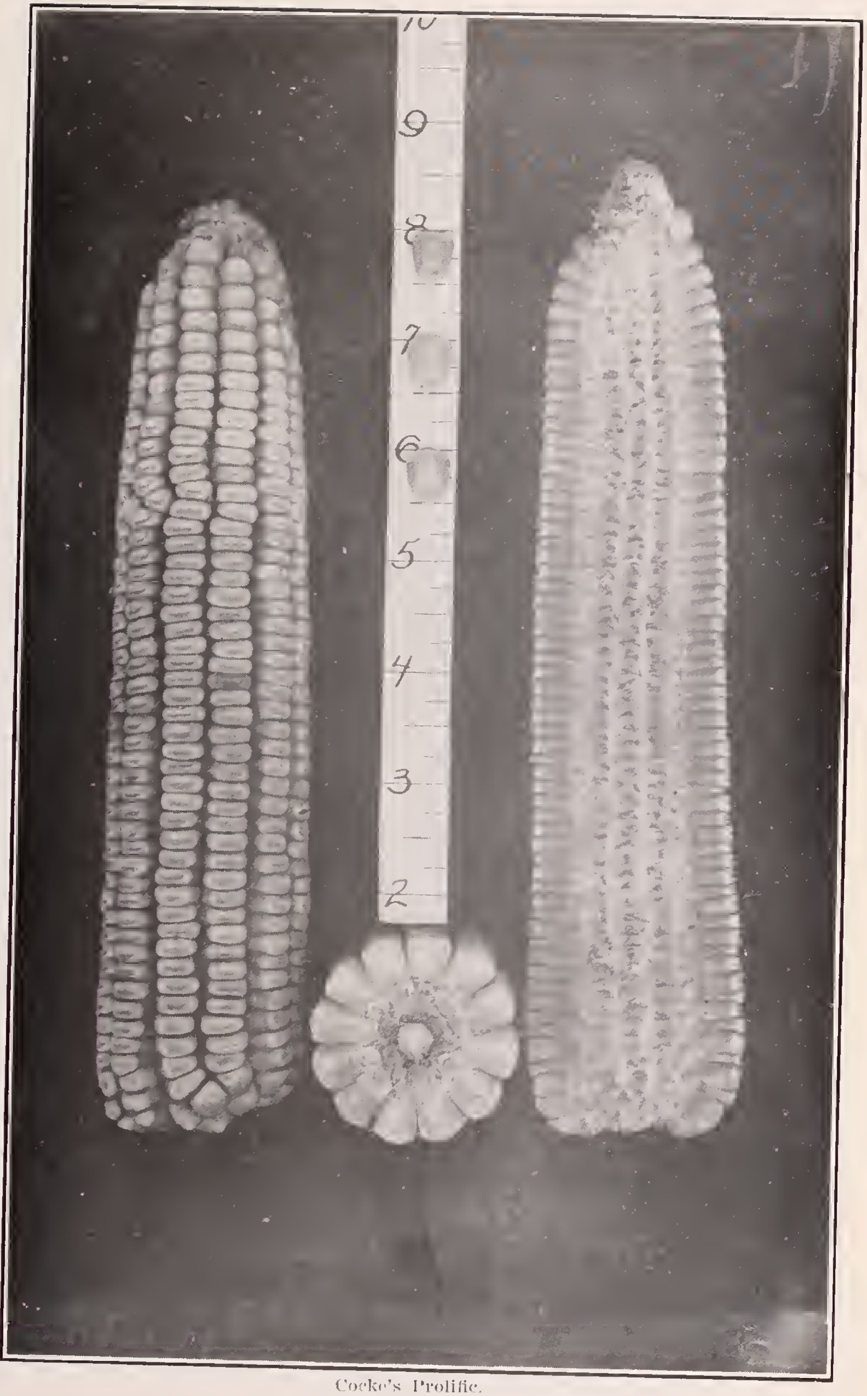

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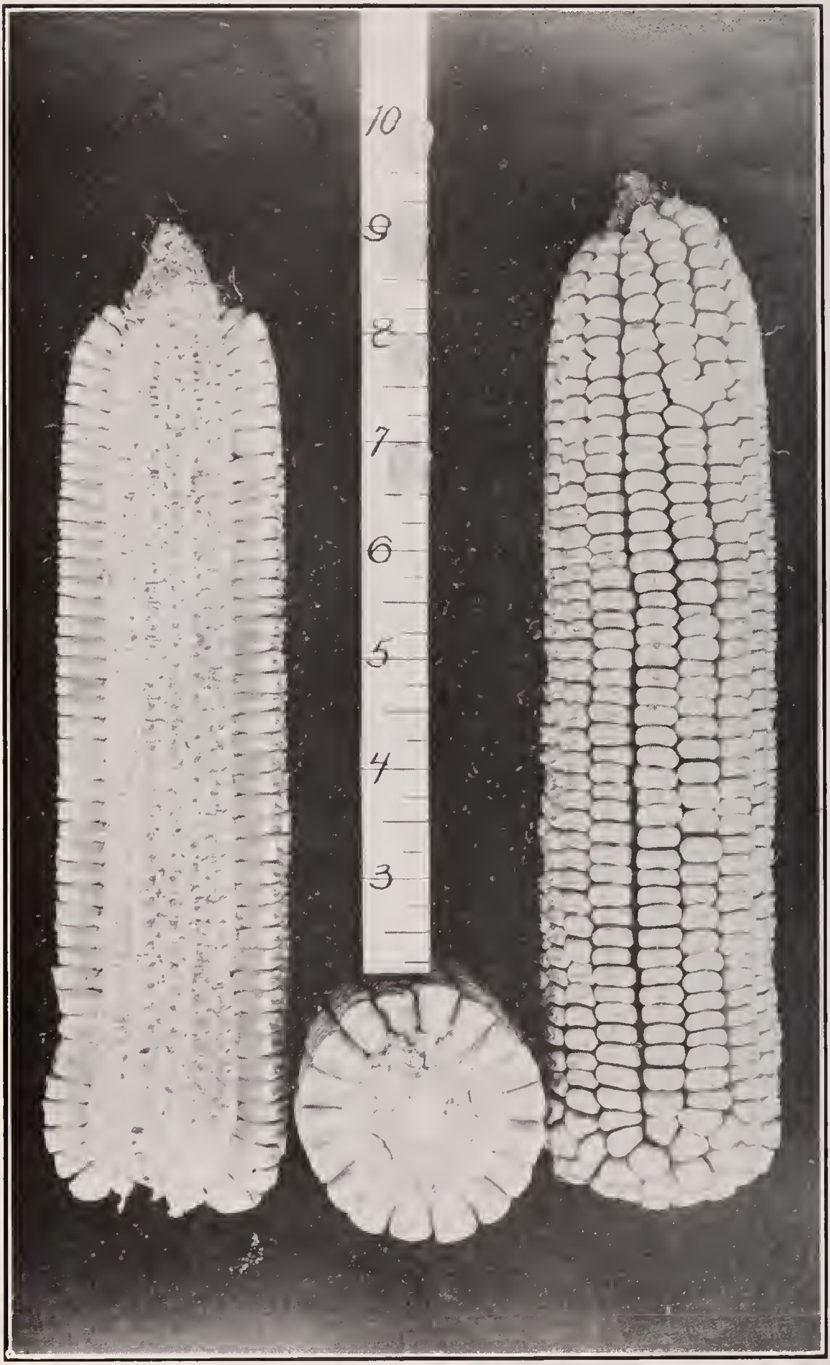

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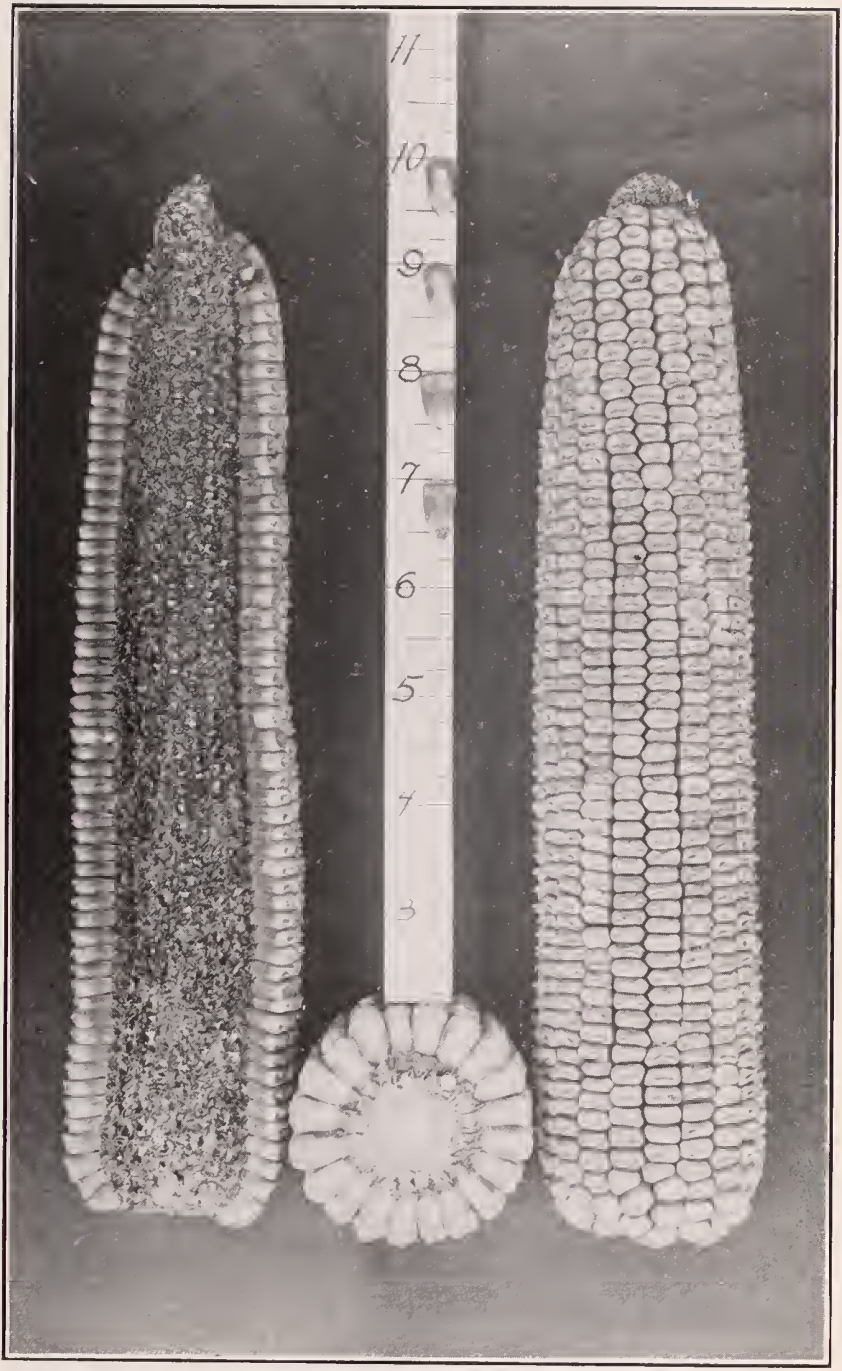

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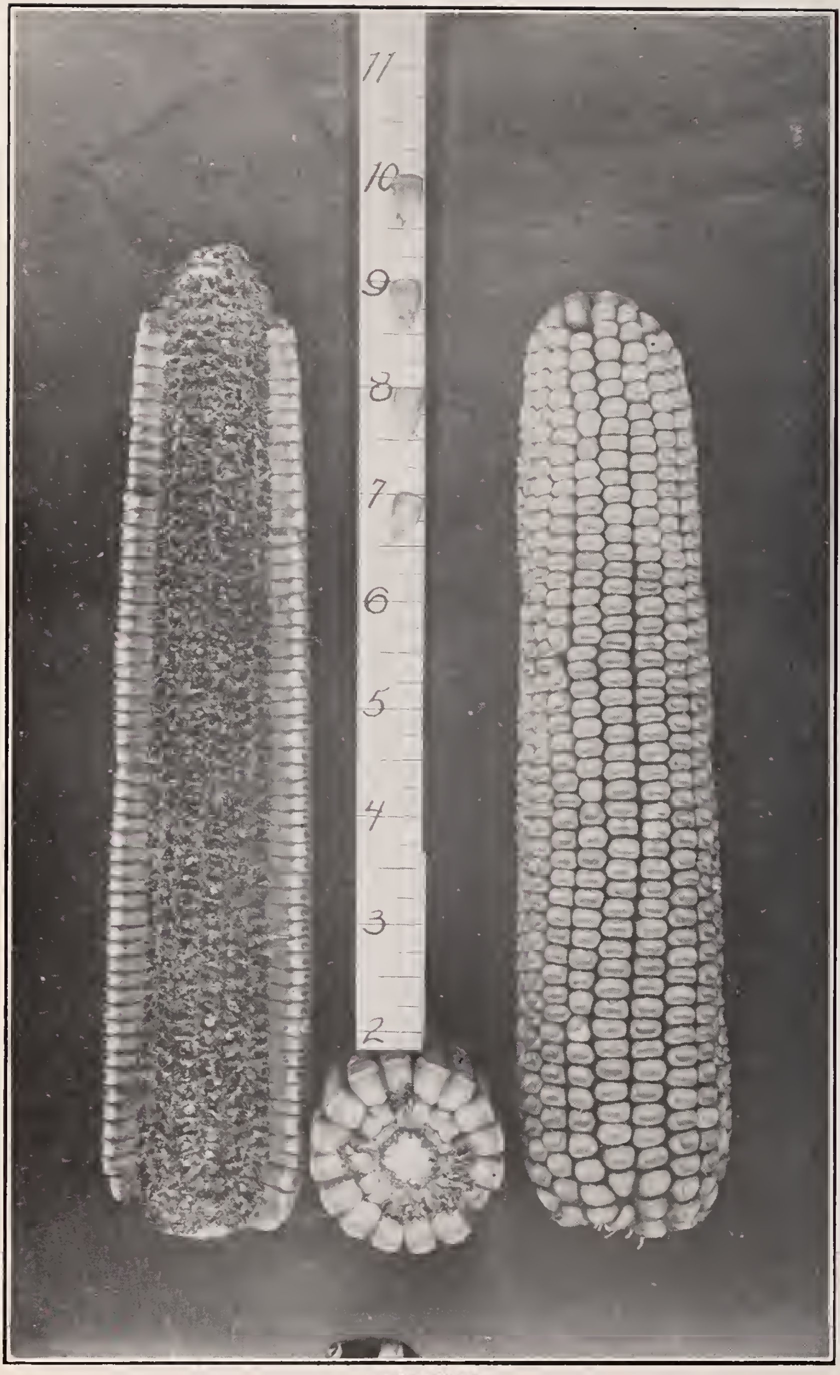

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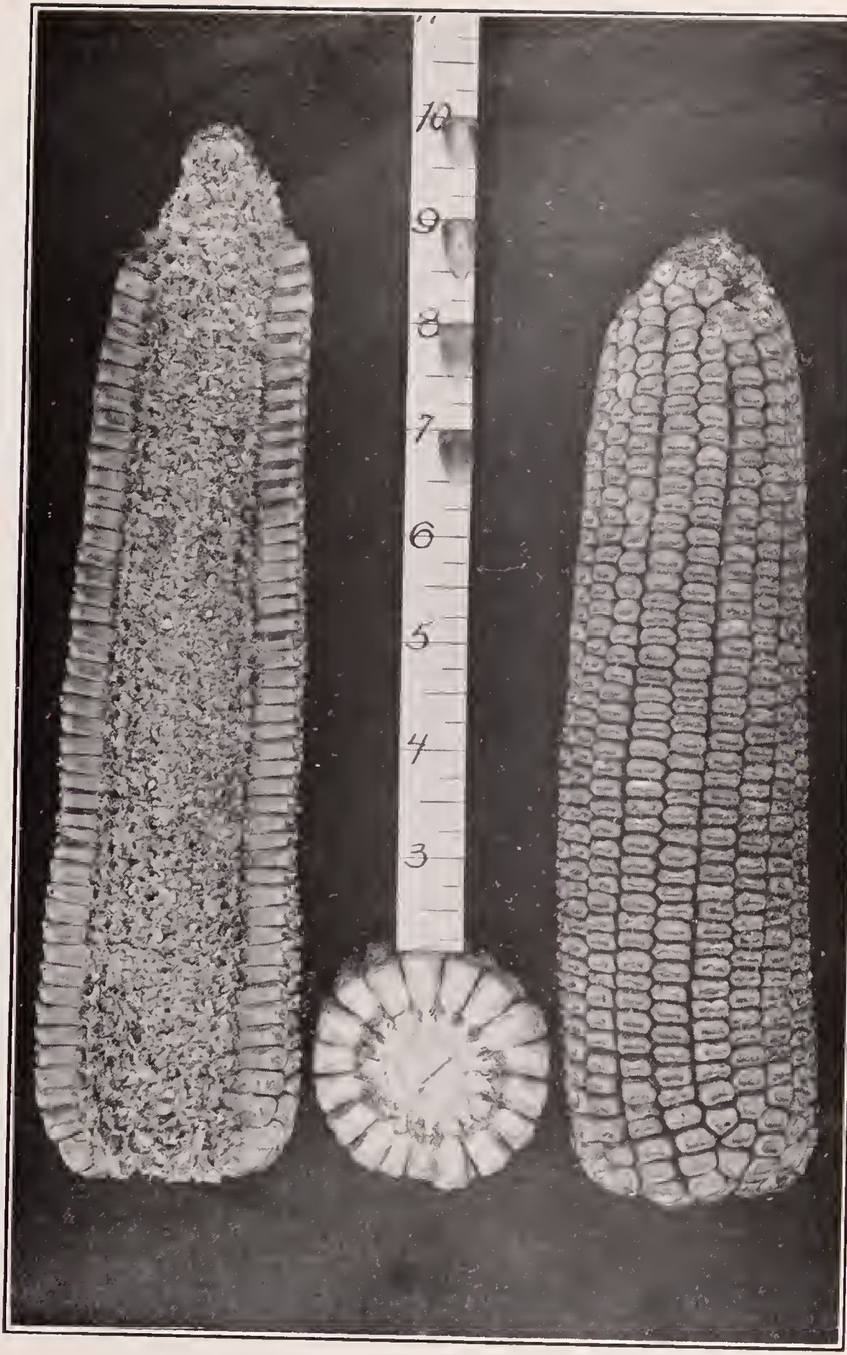

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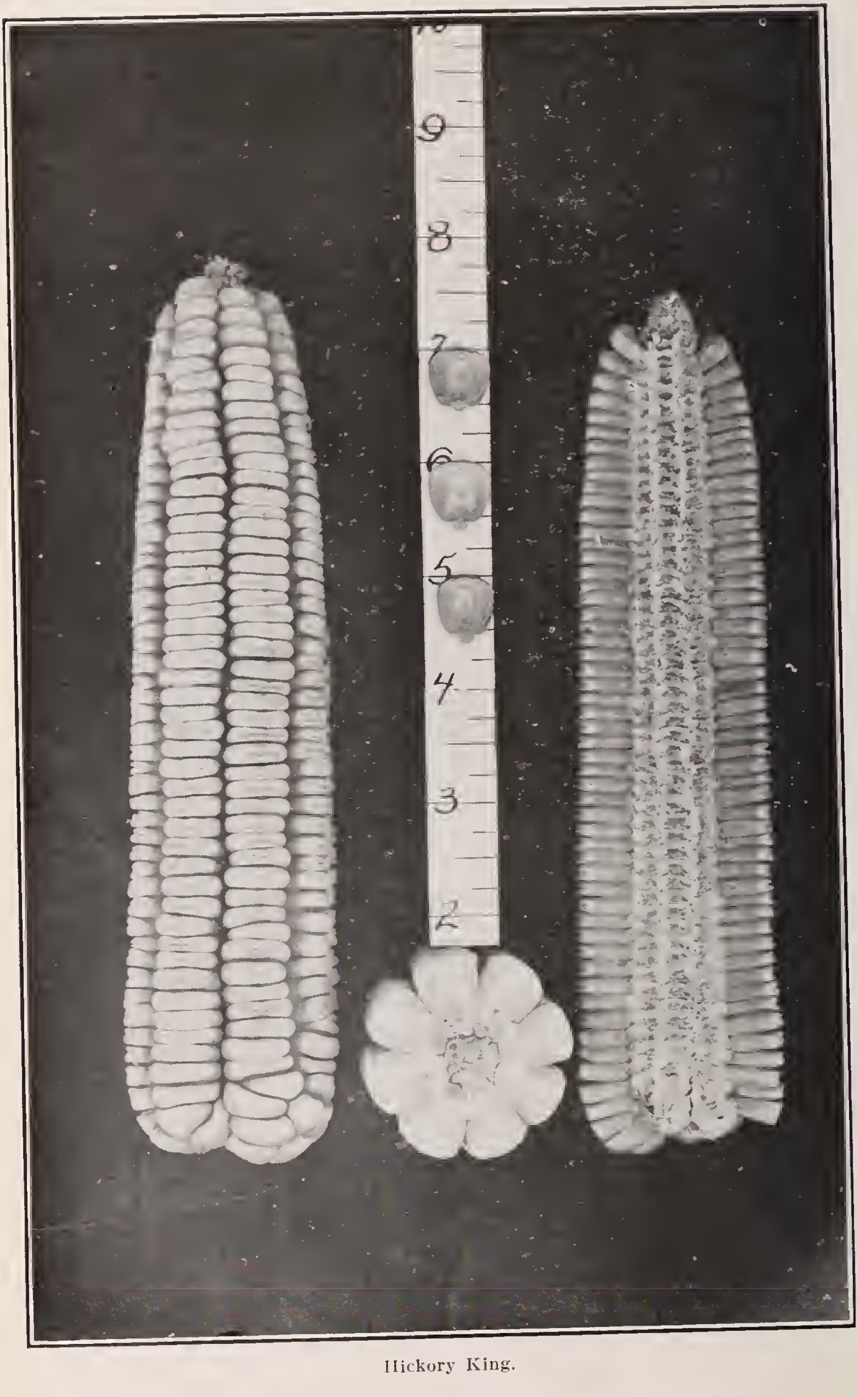

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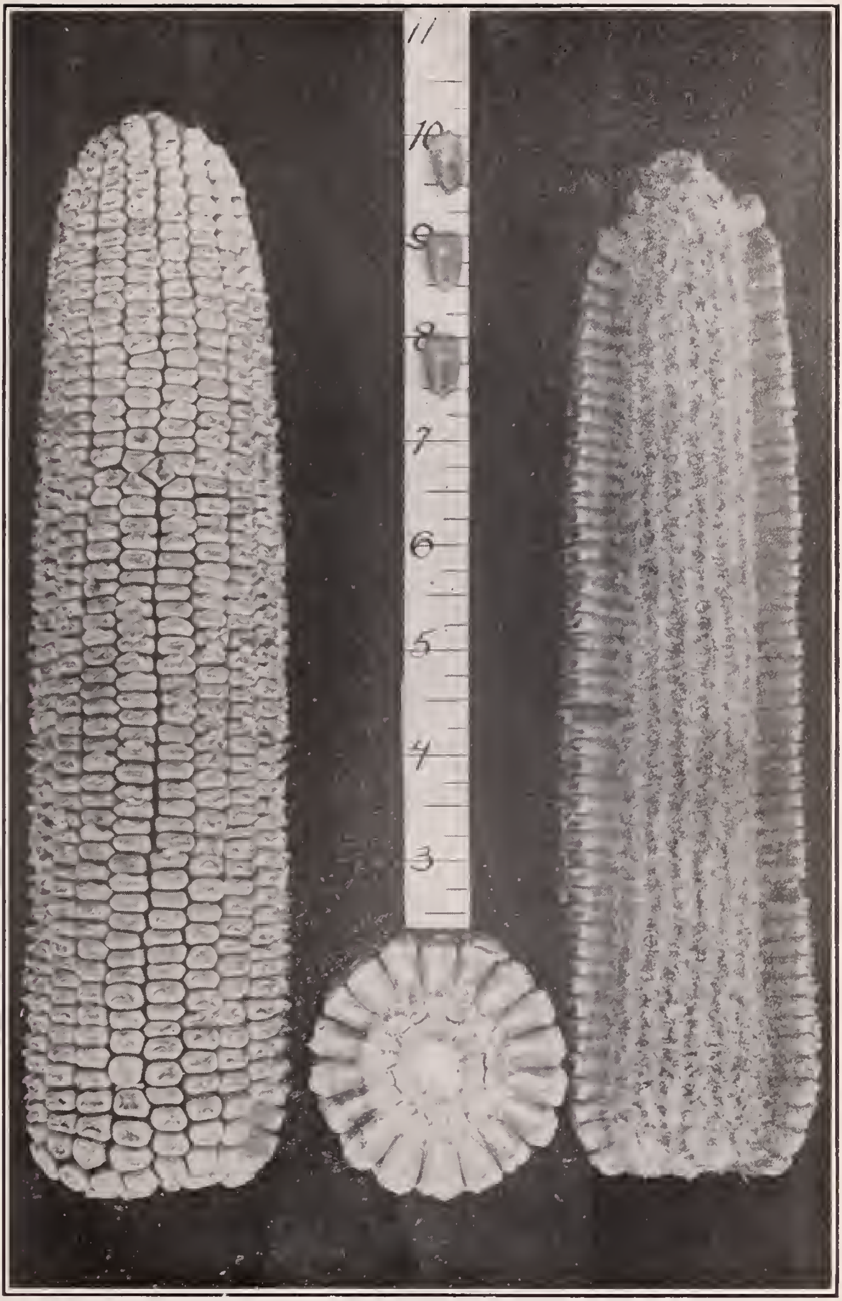

Boone County White.

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